G

UNIVERSITY
OF MICHIGAN
JUL 26 1954
PERIODICAL
READING ROOM

ANNALS

of the Association of American Geographers

HENRY MADISON KENDALL
Editor

Volume XLIV • Number 2

June, 1954

CONTENTS

A Unified Field Theory of Political Geography ..... Stephen B. Jones 111

The Geography of Recent Population Trends in the United States
Donald J. Bogue 124

Population Patterns in Tropical Africa
Glenn T. Trewartha and Wilbur Zelinsky 135

The Population Geography of Belgian Africa
Glenn T. Trewartha and Wilbur Zelinsky 163

The Winter Feeding Period in the Southern Interior Plateau of British Columbia ..... Thomas R. Weir 194

Abstracts of Papers Presented at the 50th Anniversary Meeting of the Association of American Geographers, Held at Philadelphia, Pennsylvania, April 11, 12, 13, 14, 15, 1954 205

ANNALS of the Association of American Geographers is published quarterly in March, June, September, and December at the Business Press, Lancaster, Pennsylvania

Annual subscription: $5.00; separate issues of current volume and back numbers: 75 cents to $1.50

Address all communications relative to subscriptions, purchase of back numbers, etc. to A. A. G. Central Office, Map Division, Library of Congress, Washington 25, D. C.
Submit all manuscripts to
Henry Madison Kendall, Editor, Dept. of Geography, Miami University, Oxford, Ohio

Statements and opinions in the ANNALS *are the responsibility of authors and do not necessarily reflect the views of the Association*

Entered as second-class matter August 2, 1934, at the Post Office at Lancaster, Pa. Acceptance for mailing at the special rate of postage provided for in the Act of February 28, 1925, embodied in Paragraph (d-2) Section 34.40 P. L. & R. of 1948.

ANNALS of the
Association of American Geographers

Volume XLIV JUNE, 1954 Number 2

A UNIFIED FIELD THEORY OF POLITICAL GEOGRAPHY*

STEPHEN B. JONES
Yale University

THE current urge for theory in geography reminds me of an earlier period when a scientific nomenclature was thought necessary for the maturity of our subject. From this word-seeking only a few terms have survived, yet, looking back, I do not feel that the search for words, even though it turned up some mouthfuls like "nemoriculture," was wasted effort. Many of the words disappeared, but ideas were clarified in the process of word-coining. So the current search for theory may not revolutionize geography or make it any more scientific, but a valid theory, however minor, is at least three things: a compact description, a clue to explanation, and a tool for better work. Theory in this sense is immanent in the facts of the humblest termpaper. No young geographer should feel that theory is reserved for balding professors. Anyone can contribute to theory if he sees the least bit of meaning in his work. If he lacks the wit to see meaning in facts, there is not much that a body of theory, handed down to him by his professors, can do to make him a creative scientist.

Meaning of some sort is latent in any set of related facts, and geographical facts are nothing if not related. Incubated by thought, meaning may be borne as theory. A vital theory may fertilize new masses of facts. The uniqueness of the geographer's material, the uniqueness of the regional complex he studies or of the regional context within which his study is made, is not the barrier to theory that has sometimes been claimed, for a theory is not necessarily a statistical generalization. One of the most vital of modern theories, the anthropological theory of culture, is based on the study of human cultures, which are unique when considered as wholes. Born of the study of primitive peoples in far away lands, this theory has proved a magnificent working tool throughout the world.

The most magnificent thing about the present theory is its name. You are likely to be disappointed in the content. I am not sure the theory is able to stand on its own feet in a critical world. It may, however, have its uses and the way to find out is to push it out before the public. The beginnings of this unified field theory of

* This article is derived in part from a study of national power being made under a grant from the Office of Naval Rerearch. All opinions expressed are the responsibility of the author.

political geography go back about ten years, when I was thrown among political scientists and had to teach political science students. Out of the attempt to make political geography intelligible and useful to political scientists grew the conviction that some sort of theoretical union of the fields must exist. It makes no sense to use the adjective "political" unless we mean by it something more fundamental than the mere geography of political units. The adjective, it seems to me, is just as important as the noun in defining a border field. I have been unable to split the hair that separates political geography from what might be called geographical politics. There must be a continuum from geography to politics as, indeed, there must be a continuum connecting all the sciences that study man.

That there must be a continuum between geography and political science does not mean that there is no difference between a political geographer and a political scientist. It does, I hope, mean that in the future the attitude of geographers towards political science and of political scientists toward geography may be less naive than it has been in the past. We geographers, I fear, get most of our political science from the newspapers. To many political scientists, I know, geography means physical geography, and political geography means the influence of the physical environment on politics.

Ten years ago, in the heyday of American geopolitics, I thought that political scientists would advance into and perhaps take over political geography. But interest in geopolitics has dropped. Currently, what may be called psychopolitics is a focus of interest. Studies of political behavior, of the processes of decision-making, of the images that one group forms of another are holding the attention of many political scientists. There is thus an opportunity for political geographers to expand their efforts. Unfortunately we are few in number, weighted with teaching, tapped for committees. Perhaps even more serious is the lack of a methodology that carries us surely and rapidly through the early stages of research.[1] Each of us has had to hammer out his own methodology, the hard way. If the theory I am about to present has no other utility than to provide a feeble guiding light in the wilderness, it will have served a purpose.

RELATION TO PRIOR WORK

Although its name is a vainglorious imitation of theoretical physics, the unified field theory is not based on a physical analogy. Its intellectual base includes substantial borrowings from three eminent political geographers—Derwent Whittlesey, Richard Hartshorne, and Jean Gottmann. In fact, the adjective "unified" in the title stems from the belief that the concept of "field" unifies the ideas of these three men, as well as unites them with political science.

In a paper published in 1935 which bears the now somewhat quaint title of "Recent Developments in Political Geography,"[2] Richard Hartshorne stated that

[1] cf. Richard Hartshorne, "The Functional Approach in Political Geography," *Annals of the Association of American Geographers*, XL (June 1950) : 96–97.

[2] Richard Hartshorne, "Recent Developments in Political Geography," *The American Political Science Review*, XXIX (Oct. and Dec. 1935) : 785–804, 943–966.

any definition of political geography must be based on a definition of the field of human geography. He adopted the definition of geography as the science of earth-areas. Thus political geography was defined as "the science of political areas, or more specifically, the study of the state as a characteristic of areas in relation to the other characteristics of areas."[3] As if anticipating Korzybski's general semantics, Hartshorne followed this Aristotelean definition with an operational definition. The second half of his paper opened with an outline for the study of a single state-area. The three main headings of this outline are Descriptive Analysis, Interpretation, and Appraisal, but all three parts are essentially chorological and morphological. Such items as political events, political power, and political processes are touched on very gingerly and only to the extent that they serve to explain the development of the state-area.

The logic of "Recent Developments" seemed unimpeachable to the present writer, who is a chorologist at heart, and it was a blow to find that it aroused no enthusiasm among his political science students. From their point of view, all the channels of event, power, and process that might have connected political chorology with their own problems seemed dammed or dried up. Moreover, as we all know, Hartshorne himself became dissatisfied with the morphological approach, castigating it, in his presidential address, far more severely than the present writer thinks it deserves.[4] He calls it "static and dull," "putting the cart before the horse." Such self-criticism hardly seems necessary, for morphology can be fascinating and, in science, a cart can become a horse, and vice versa, as knowledge develops. Let us say, rather, that the error of "Recent Developments" lay in enthroning morphology and in reducing to humble servitude those concepts that might have united it with political functioning.

Hartshorne's famous presidential address of course added function to his theory of political geography. The departure from the path of "Recent Developments" was not however a complete change of direction. The emphasis of "The Functional Approach" was still on the state-area and, for convenience, the discussion was limited to organized states of the national variety. For the present purpose, the pertinent part of "The Functional Approach" is the discussion of centrifugal and centripetal forces operating in the state-area.

The centrifugal forces that tend to pull a state-area apart include physical barriers (which, Hartshorne points out, have largely been overcome in most modern states by the telegraph and railroad, not to mention newer forms of circulation), human barriers, differences in regional relations with outside states, different regional characteristics of populations, economic interests, and political attitudes. The miracle of state formation requires centripetal forces to overcome the centrifugal forces. The basic centripetal force, according to Hartshorne, is "the idea of the state." The state-idea need not be identical with nationalism, though it has been increasingly congruent with it. Not all ideas for states are viable state-ideas. The

[3] Hartshorne, "Recent Developments . . ." :804. (Italics in original omitted.)
[4] Hartshorne, "The Functional Approach . . .": 99–100.

Holy Roman and the Austro-Hungarian emperors had ideas for forming states for which they could create no mass acceptance. Hartshorne points out that political science has been more concerned with generic concepts such as nationalism and federalism than with the state-ideas of particular states, so the political geographer must pursue politics and history far enough to nail down the raison d'etre of his particular object of study.

"The Functional Approach" was only two years off the press when Jean Gottmann presented related thoughts upon the political partitioning of the world.[5] Like Hartshorne, he speaks of two sets of forces, which are called circulation and iconography. Circulation is used in the sense familiar to geographers, to cover communication and movement of many kinds. Iconography describes "the whole system of symbols in which a people believes." "Symbol" is used broadly enough to include memories of past history and principles of religion, so we may think of iconography as a system of beliefs from which symbols, material and non-material, arise. Circulation is a system of movement, iconography of resistance to movement. Circulation, according to Gottmann, makes for change, iconography is a factor of political stabilization. Circulation permits space to be organized, and technical improvements in circulation make theoretically possible the widening of organized space. Iconography lags behind technology and expands its areas with difficulty. Circulation and iconography are not always in spatial conflict. Both focus at crossroads, though it would seem that circulation usually comes first, creating the crossroads, and that iconography fixes itself at the point so established.

There are similarities and differences between the ideas of Hartshorne and Gottmann. Hartshorne recognized that circulation was a means of overcoming the physical barriers to state integration, but he did not list it as a centripetal force nor discuss its possible role in the development of a state-idea. He appears to consider circulation an expression of economic and political forces, rather than a primary force. Certainly an established state-area conditions the pattern of circulation to an astonishing degree, even though circulation originally helped shape the state-area. Iconography also can be recognized in Hartshorne's theory, both as the third of his centrifugal forces—"regions that differ among themselves in character of population, economic interests, and political attitudes"—and as the master centripetal force itself, the state-idea. Circulation, according to Hartshorne, does not necessarily make for instability and change. It may help stabilize a state, as railroads have done for Canada. Iconography does not always make for stability. There can be conflicts of lesser and greater iconographies, of sectionalism and nationalism, of national and international iconographies. Another of Hartshorne's ideas, that of the maturity of states, expresses a state-area co-extensive with the national iconography.[6]

[5] Jean Gottmann, *La politique des états et leur géographie.* Paris, 1952. Especially Chapter 8. Summaries of Gottmann's ideas appear in two articles by him: "Geography and International Relations," *World Politics,* III (Jan. 1951): 153-73, and "The Political Partitioning of Our World: An Attempt at Analysis," *World Politics,* IV (July 1952): 512-519.

[6] Richard Hartshorne, "The Concepts of 'Raison d'Etre' and 'Maturity of States'," (ab-

THE IDEA-AREA CHAIN

Let us proceed to our unified field theory of political geography. The theory simply states that "idea" and "state" are two ends of a chain. The hyphen with which Hartshorne connects them represents the three other links of the chain. One of the links is Gottmann's circulation, which I shall call movement.[7]

The chain is as follows: Political Idea—Decision—Movement—Field—Political Area. This "chain" should be visualized as a chain of lakes or basins, not an iron chain of separate links. The basins interconnect at one level, so that whatever enters one will spread to all the others.

Political idea, in this sequence, means more than just the state-idea. It means any political idea. It might be the idea of the state or it might be the idea of a speed limit on a country road. It might merely be a gregarious instinct, not consciously expressed. "War begins in the minds of men" and so does all other politics. But there are many political ideas that never reach the stage of action. They die aborning, remain in the realm of pure thought, or are rejected by the powers-that-be. A favorable decision is a necessary prerequisite to action. A formal, parliamentary decision is not necessarily meant. Much current research in political science is focussed on the informal or unconscious aspects of the idea-decision end of the chain, through studies of political behavior. Though most of the fishermen in the basins of idea and decision are political scientists, Gottmann and Hartshorne, both geographers, enter them when they speak of iconography and the idea of state.

Both political scientists and geographers have studied the phenomena at the other end of the chain—political areas. This term is used very inclusively to mean any politically organized area, whether a national state, a dependent area, a subdivision of a state, or an administrative region or district. It includes all three categories of areas listed by Fesler[8]: general governmental areas, special or limited-purpose governmental areas, and field service areas. The one common characteristic of all political areas is that they have recognized limits, though not necessarily linear or permanent. An administrative center within the area is common, but not universal.

Movement, I have said, is essentially Gottmann's circulation. What new twist it is given comes from placing it in a chain of concepts relating it to decisions. Every political decision involves movement in one way or another. There may be exceptions, but I have been unable to think of any. Some decisions create movement, some change it, some restrict it. Some create a new kind of movement to replace or to control the old. The movement may not involve great numbers of men or great quantities of matter—it may consist only of radio waves—but usually persons and things move as a result of political decisions. These politically-induced movements may be thought of as "circulation fields." The movements of state high-

stract), *Annuals of the Association of American Geographers,* XXX (March 1940): 59.

[7] Gottmann himself thinks "movement" an inadequate translation and suggests "movement factor" ("The Political Partitioning of Our World": 515). The present writer has adopted "movement" as more compact and commonplace than either "movement factor" or "circulation."

[8] James W. Fesler, *Area and Administration.* University, Alabama, 1949. p. 6.

way patrolmen produce a field, shipments of military-aid materials produce a field, the despatch and delivery of farm-subsidy checks produce a field.[9]

A concrete example may clarify the thought behind this chain of terms. National prohibition had a long history as an idea. The Eighteenth Amendment and the Volstead Act were the final decisions that took national prohibition from the realm of ideas to that of action, though, to be sure, many smaller decisions had preceded these or were necessary later to implement them. The prompt effect of the Volstead Act was to inaugurate sweeping changes in movement. Legal shipment of liquor ceased, raw materials no longer flowed to distilleries, illicit movements were organized along new lines, enforcement officers went patrolling and prowling. The fields of these movements were not of uniform density nor did they exactly coincide with the boundaries of the United States. City slums and Appalachian valleys became centers of activity. Zones near the international frontiers were heavily policed. Enforcement reached twelve miles to sea. The effect on movement was felt overseas. No change in national territory resulted, but new administrative areas were set up. Had the law remained and been rigidly enforced, it is conceivable that our concept of the marginal sea might have changed, as later it was changed by the expanding field of activity of oil exploration. An earlier and more successful attempt at compulsory reform—the suppression of the slave trade—produced a field of enforcement on the high seas and led to the establishment of colonial areas in West Africa. Similarly, the idea-to-area chain is beautifully illustrated by the founding of Liberia.

In the case of prohibition, the existence of the political area of the United States gave general shape to the major fields produced by the Volstead Act, for obvious reasons. A political area in being is a condition of political ideas, decisions, and movements. Our linked basins, I have said, lie at one level. Add something to one, and it spreads to others. There is a general distinction, however, between flow from idea towards area and in the reverse direction. The former is essentially a process of controlling or creating. The prohibition law controlled some movements and created others. The idea of colonizing free negroes created a migration to Liberia. The reverse spread is more correctly described as conditioning. The existence of a political area, field, movement, or decision conditions what may take place in the basins lying idea-ward. Eric Fischer's paper, "On Boundaries," is full of good examples of such conditioning.[10] Benjamin Thomas has shown how the political area of Idaho, created upon a flimsy and essentially negative idea in the first place, conditioned further political thoughts and decisions until the present Idaho-idea is as firm as any.[11]

[9] The general outlines of this theory were presented to a small audience at the University of Toronto in the spring of 1952. At that time, Dr. Ali Tayyeb suggested that, since political science tends to focus on ideas and decisions and political geography on political areas, the links of movement and field might be called geopolitics. My feeling is one of regret that "geopolitics" has been used in so many ways that this interesting suggestion may be impractical.

[10] Eric Fischer, "On Boundaries," *World Politics*, I (Jan. 1949): 196–222. The final paragraph on page 197 is a good description of the conditioning process.

[11] Benjamin E. Thomas, "Boundaries and Internal Problems of Idaho," *The Geographical*

The essential characteristic of a field, in physics, is not movement, but spatial variation in force. The gravitational field exists even when no apples fall. Since we are not bound to a physical analogy, this distinction need not greatly concern us. However, it may sometimes be important to keep in mind that movements and fields are not necessarily identical. A higher percentage of Democrats goes to the polls where the party is neck-and-neck with the Republicans than where the party is overwhelmingly strong. Movement to polls creates a field, but it is not identical with the field of party power.

In a recent publication,[12] Karl Deutsch has suggested a "field" approach to the study of political community. "According to this view, every individual is conceived as a point in a field consisting of his communications or other interactions with all other individuals." Deutsch suggests that this concept may be applied to both small and large "clusters," including families, villages, towns, countries, regions, peoples, nations, and federations. Some clusters are political areas, some are geographical but not political areas, others, like families and peoples, are not necessarily found in definable areas. Thus Deutsch's "interaction field" may be the general case of which the present writer's concept may be the politico-geographical sub-type. On later pages of the same publication,[13] Deutsch gives fourteen tests of integration and a check-list of thirty-two possible indicators of social or political community, which should prove of value to the geographer as well as the political scientist.

A field exists in time as well as in space. Applying the ideas of Whittlesey,[14] we may say it has a time dimension as well as space dimensions and that the time dimension has three derivatives: velocity, pace, and timing. Highway patrols produce a field, as was mentioned above, but obviously it is important for both law-breaker and law-enforcer to know when the patrolmen operate as well as where. The effective scheduling of their patrols is a problem in timing. The whole of traffic and of traffic regulation can be considered a space-time field. Warfare and traffic are alike in this respect as in some others.

APPLICATION TO POLITICAL AREAS

Application of this theory to a case of one new national state is fairly simple: zionism is the idea, the Balfour Declaration the conspicuous decision, permitting migration and other movements. A field of settlement, governmental activity, and war leads to the state of Israel. Such telegraphic brevity oversimplifies history, but the theory seems to fit. For a state with a longer and more complicated evolution, history could not be so readily compressed. The theory provides a path between geographical and political study, but not necessarily a short-cut. It does not reduce

Review, XXXIX (Jan. 1949): 99–109.

[12] Karl W. Deutsch, *Political Community at the International Level: Problems of Definition and Measurement.* Organizational Behavior Section, Foreign Policy Analysis Project, Foreign Policy Analysis Series No. 2, Princeton University, September 1953. 30–31.

[13] Deutsch, *op. cit,* 37–62 and 70–71.

[14] Derwent Whittlesey, "The Horizon of Geography," *Annals of the Association of American Geographers,* XXXV (March 1945): 1–36.

political geography to five easy steps. It does not permit world politics to be shown on a chart in five columns headed "idea," "decision," and so forth. It may, however, provide some intellectual clarification and it may prove a handy way of working back and forth among historical, political, and geographical ideas and data.

Karl Deutsch has recognized eight uniformities in the growth of nations from other political forms of organization.[15] Five of these are clearly "field" phenomena: the change from subsistence to exchange economy, the growth of core areas, towns, and communication grids, and the concentration of capital and its effect on other areas. The seventh and eighth are "iconographical," but have "field" connotations: the growth of ethnic awareness and its relation to national symbols and to political compulsion. The sixth item, the rise of individual self-awareness, is more difficult to relate directly to a field though decisions made in a framework of an increasingly individualistic philosophy would lead to changes in established fields. In short, the process of national integration, whether looked at by geographers, like Hartshorne or Gottmann, or by a political scientist, like Deutsch, can be interpreted as a process of changing fields. Conceivably the outlines of the political area may not change. The former colony of Burma is perhaps en route to becoming a true national state without change of boundaries or capital, but a study of the political fields would show changes.

One virtue of the field theory is that it is not confined to politically organized areas. It is applicable without difficulty to an unorganized area like the Mediterranean, which is undoubtedly a political field. As William Reitzel showed, decisions may affect the Mediterranean as a whole and may create or control movement over the entire sea.[16] The ideas may vary: Mussolini's dream of a new Roman empire, Britain's concern with sea command, the American strategy of the containment of communism. Reitzel showed how American policy in the Mediterranean evolved as the cumulative result of small decisions taken first with the idea of winning specific military campaigns. These decisions, and the successful military movements that resulted, involved the United States in political and economic administration. The Soviet Union replaced the Axis as the rival Mediterranean power, Britain slumped down the power scale, and the United States found itself deeply embedded in Mediterranean politics. The Truman Doctrine of support to Greece and Turkey was an outcome, indicating the unity of the Mediterranean sea-power field. The accumulation of decisions created a field, the sea conditioned it.

In the case of administrative areas, a political area may arise from a decision with little or possibly no intervening movement. A new governmental agency may lay out its field service areas before it actually engages in any actions. In some cases, analysis will show that these field service areas reflect pre-existing fields, such as the areas used by other branches of government or known fields of economic activity,

[15] Karl W. Deutsch, "The Growth of Nations: Some Recurrent Patterns of Political and Social Integration," *World Politics*, V (Jan. 1953): 168–195.

[16] William Reitzel, *The Mediterranean: Its Role in America's Foreign Policy*. New York, 1948.

and in many cases existing boundaries will be followed. It is possible, however, that an administrative area might spring directly from a decision and reflect no existing field. T.V.A. may be an example, unless we say a field had been created by river boatmen, hillside farmers, hydrographic surveyors, and so forth. This seems far-fetched; rather it seems that the Tennessee Valley was proclaimed a political area and that a field of activity resulted. It should be noted, however, that the field spread beyond the limits of the drainage basin, once electricity began to circulate.

There is nothing deterministic about the idea-area chain. A given idea might lead to a variety of areas, a given area might condition a variety of ideas. Pelzer's study of Micronesia under four rulers demonstrates this point.[17] Although the area ruled was not identical in all four eras, it was basically the same. The number of possible uses for these small islands was limited. Nevertheless, the four rulers—Spain, Germany, Japan, and the United States—made different choices. Their fields were different in kind and intensity. If one insists (which the dictionary does not) that a theory must be able to predict specific behavior, then the field theory may not deserve its name.[18] With no theory whatsoever, a well-informed person with some map-sense could have predicted many American problems and decisions in Micronesia. As a guide to study, however, the field theory is applicable to such cases.

STUDIES OF NATIONAL POWER

Studies of national power may also be fitted into the field theory. Lasswell and Kaplan define power as "participation in the making of decisions."[19] If power is participation in the making of decisions, if power is necessary before an idea can produce movement, then we can easily fit power into our theory. Hartshorne distinguished between political geography and the study of power.[20] He felt a geographer might sometimes tackle the question of "how strong is a state?" if no one else had done so, but that in so doing he was "migrating into a field whose core and purpose is not geography, but military and political strategy." That power is linked with decision supports Hartshorne, to the extent that geography has been more closely associated with the other end of the chain, but our aim is to pull political science and geography together, not to separate them. If power is more concentrated in the basin of decision, it is by no means absent in the others.

BOUNDARIES, CAPITALS, CITIES

The unified field theory fits boundary studies into the general pattern of political geography. A boundary is of course a line between two political areas, but it is

[17] Karl J. Pelzer, "Micronesia—A Changing Frontier," *World Politics, II* (Jan. 1950): 251–266.

[18] The definition of "theory" most appropriate to the present paper is: "The analysis of a set of facts in their ideal relations to one another." Webster's Collegiate Dictionary, fifth edition, 1947.

[19] Harold D. Lasswell and Abraham Kaplan, *Power and Society: A Framework for Political Inquiry.* New Haven, 1950. p. 75.

[20] "The Functional Approach . . .": 125–127.

also a line in a region, as was emphasized in Hartshorne's Upper Silesia study and in the present writer's book.[21] The boundary region is truly a field in which the line between the political areas conditions much of the circulation.[22] A boundary field may even be or become a political area as in the case of buffer states and frontier provinces.

Studies of capital cities also may be expressed in field-theory terms. Cornish listed the crossways, the stronghold, the storehouse, and the forward headquarters as characteristic situations for capital cities.[23] To these Spate added the cultural head-link.[24] There are other possibilities, such as compromise sites and geometric centrality. All of these words have meaning in terms of movement and field either explicitly (as in the case of crossways, forward headquarters, and cultural head-link) or implicitly (as in the case of storehouse). The idea of, or need for, central administration leads to a decision on the site of the capital. The choice is conditioned by the field and in turn distorts or recreates the field. Once the capital is chosen and the field about it established, many further decisions and movements are conditioned, leading in most cases to the creation of a primate city much larger than any other in the country.[25]

Not only capitals, but other cities, may be brought into the scope of the theory. In Gottmann's terminology, many of the problems of a growing city arise from the fact that its circulation expands faster than its iconography. The metropolitan district outgrows the political limits, and vested local interests and loyalties make political expansion difficult. A sort of "metropolitan-idea" may develop, leading usually to functional authorities rather than to political integration. In a few words, the urban problem is to make the political area fit the field.[26] There are a number of choices possible such as annexation of suburbs, city-county consolidation, metropolitan districts, functional authorities, state assumption of local functions.

KINETIC AND DYNAMIC FIELDS

Since politics consists of conflicts and the resolution of conflicts (though neither conflict nor resolution need be accompanied by violence), these fundamental activities must be expressible in field terms. There are conflicts of ideas, but they do not amount to much until they are embodied in decisions that create or obstruct movement. (It may be wise to re-emphasize that "movement" includes such things of

[21] Richard Hartshorne, "Geographic and Political Boundaries in Upper Silesia," *Annals of the Association of American Geographers*, XXIII (1933): 195–228. Stephen B. Jones, *Boundary-Making: A Handbook for Statesmen, Treaty Editors and Boundary Commissioners*. Washington, 1945. Especially Part I.

[22] The pertinence of Eric Fischer's work on historical boundaries has already been mentioned.

[23] Vaughan Cornish, *The Great Capitals, an Historical Geography*. London, 1923.

[24] O. H. K. Spate, "Factors in the Development of Capital Cities," *The Geographical Review*, XXXII (Oct. 1942): 622–631.

[25] Mark Jefferson, "The Law of Primate Cities," *The Geographical Review*, XXIX (April 1939): 226–232.

[26] A. E. Smailes, *The Geography of Towns*. London, 1953. pp. 153–156.

little bulk as messages and money. A restriction on foreign exchange is a restriction on movement.) Fields may be in contact, but not in conflict, may indeed overlap but not conflict, if the movement is merely kinetic. But if there is a dynamic aspect, conflict often will arise. For example, New York City's growing need for water forces its activity in this respect to be dynamic, bringing conflict with other claimants to Delaware River supplies. The international oil industry is inherently dynamic, since new sources must be discovered. The result is potential conflict, sometimes anticipated and resolved at least pro tempore. The relations of political dynamics to such fundamentals as resource needs and population pressures have of course been repeatedly studied,[27] and the present theory does little more than incorporate them into the concept of the field.

The general attitude of Americans toward world politics is that dynamic problems should if possible be reduced to kinetic situations by agreement, or in other words that dynamic fields should be converted to kinetic fields. The philosophy of communism, however, is in many respects the opposite, except for temporary tactical purposes. In its grand strategy, communism would like to convert kinetic fields to dynamic fields, with the pressure from the communist side, of course. (The Nazis held a similar philosophy.) The failure of the United States to understand this difference accounts for a number of American blunders in diplomacy. The notion of peaceful co-existence of capitalism and communism, sincerely held by millions outside the Iron Curtain and occasionally uttered, with what sincerity is not known, by major figures within the Curtain, expresses the belief that the fields of the two ideologies can be merely kinetic in their relations, a belief that so far has little to support it.

There are no upper or lower limits on the magnitude of an idea. Man thinks easily of world government and can dream of space-ships and planetary empires. There are upper limits on decisions, movements, fields, and political areas, though these limits change with events (often, but not necessarily, upwards). Such ideas as the great religions, nationalism, liberalism, and communism have, in so far as they could produce decisions and movements, created fields. Whittlesey has shown how man's ideas of space have changed through primal and regional to worldwide conceptions, and how the third and fourth dimensions of the human habitat have been explored and put to use.[28] Ideas, fields of exploration, in some cases political areas have expanded, reached above and below the earth's surface, and made better use of time. The idea of a Columbus, the decision of an Isabella, a voyage of discovery, a new field, a new empire—this progression might figuratively be compared to the idea of a chemist, the decision of an entrepreneur, an experiment, a new field of production, an economic domain.

Many of the most influential of ideas have been composite, or "culture-ideas." Western culture, for example, is more than just capitalism or democracy or Chris-

[27] For examples, by Frederick S. Dunn, in his *Peaceful Change*. New York, 1937. and by Brooks Emeny, in *The Strategy of Raw Materials*. New York, 1934.

[28] "The Horizon of Geography."

tianity—it is a composite of these and other factors. Toynbee holds that every culture tends to evolve its "universal state," a domain roughly co-extensive with the culture.[29] If this is true, then we have another example of the chain from idea through a vast number of decisions (not necessarily consciously derived from the general culture-idea) and movements, creating a field and tending towards a political area which would be the universal state of that culture.

UTILITY OF THE THEORY

It is time to get back down to earth from the heights and ask that rude question, "So what?" Here is a theory; what can it *do*? Is it just word mongering? Of course, mere words have uses. A word of general meaning may replace phrases, sentences, even whole paragraphs. Whether "field" is such a word remains for time to tell. Or, as we said at the start, the word may die, but the clarification of thought that went into its coinage or adoption may be a useful accomplishment. Here, again, only time can tell whether thought has been clarified or made more murky by this paper.

On an earlier page it was said that a valid theory, however minor, is at least three things: a compact description, a clue to explanation, and a tool for better work. If this theory merely provides nomenclature it satisfies the first requirement. Perhaps it goes farther than merely supplying words. It may reduce the apparent diversity of aims and methods in political geography, found by Hartshorne and his students.[30] It may help to unify not only the theories of political geography, but political theories in general. It may help complete the tie between morphology and function, between region and process. It may show a relationship between "grand ideas" and the earth's surface.

This unified field theory can provide no more than a clue to explanation, if it even attains that success. It can hardly provide an ultimate answer to any question. But to relate several disciplines, to show connections, may give hints. The user of this theory is at least sure to be warned against single-factor explanations and be led to seek contributions from sister sciences.

It is as a tool for better work that I have the most hopes for this mental gadget. The chain of words in which the theory is expressed constitutes a sort of check-list ("check-system" might be better), by means of which one can orient oneself and tell where one should explore further. To return to the analogy of a chain of basins, one knows through which basin one has entered and where one can travel back and forth. If one begins with the study of a political area, ideas lie at the other end. If a study begins with movement, the scholar knows he should explore in both directions. For some of the basins one may need pilots from other disciplines, but at least one has a map of the chain. The theory tells students of geography and politics

[29] Arnold Toynbee, *A Study of History*. London, 1939. Vol. 4, pp. 2–3.

[30] "The Functional Approach . . .": 96–97.

what (in very general terms) they need to learn from each other, what each has to add, but not how each fences himself off.

Another possible effect of this theory upon geographical work is that it may inspire the making of new types of studies and the compiling of new kinds of maps. Many maps either show or imply a field, but with the idea-area chain in mind, new sources of data suggest themselves: public-opinion polls, content analysis of publications, shipments of significant materials, movements of governmental officers, monetary transactions and so forth. The theory is "geographical" in that it makes mappable, through the concept of the field, the results of ideas and decisions that are themselves not mappable.

Conceivably the general plan of this theory can be extended to other than political studies. In fact, recent work in economic geography suggests a similar theory for that branch of our science. The idea-area chain may unite in one concept two main parts of geographical theory, the possibilist and regionalist views. Possibilism focusses on man's choices among environmental possibilities. Choices are decisions. They imply ideas and must lead to movements. The regional or chorological approach, beginning with the study of areas, can lead through movement to decisions and ideas.

Finally, the unified field theory may have utility outside academic circles. It seems possible that the concept can be used as an aid in evaluating diplomatic and strategic ideas and plans. This is an ambitious thought and may prove illusory. However, diplomacy and strategy begin with ideas, lead to decisions, result in movement, and therefore produce fields. In reverse, diplomacy and strategy are conditioned by the political areas and fields of the earth, which limit the possible decisions and practical ideas. No doubt such thinking goes on in high places unaided by our theory, but perhaps this bit of intellectual guidance will clarify some cases.

Accepted November 1953

THE GEOGRAPHY OF RECENT POPULATION TRENDS IN THE UNITED STATES*

DONALD J. BOGUE

Scripps Foundation (Miami University of Ohio) and University of Chicago

THIS paper undertakes to accomplish two objectives. First, it attempts to develop the thesis that there is need for a strong injection of some principles of economic and human geography into the study of human populations. Second, by tracing out a few of the major population changes which occurred between 1940 and 1950 it demonstrates that such an approach is particularly necessary in order to describe and explain recent population trends.

In the past there has been a rather common tendency among social scientists to study statistics showing change or trends at the national level, without bothering to examine them in terms of the major socio-economic environments into which the nation may be subdivided. This point of view leads, almost unconsciously, to two unwarranted implications: (a) that whatever changes and trends are noted for the nation as a whole also characterize each part of the nation with equal validity, and (b) that trends are self-generated events whose direction and rate of change can be traced in the past and extrapolated into the future, but which cannot really be rigorously "explained." One way of attempting to escape the dangers of this approach is to study each event in terms of geographic regions and subregions, as well as at the national level.

Those few social statisticians who are systematically studying national trends in terms of their regional and subregional constituents are discovering that a national "trend" turns out to be no more than a complex weighted average of numerous local changes, many of which tend to cancel each other by operating in opposite directions. Variations in the direction and intensity of these local trends have been shown, in a high proportion of cases where the experiment has been tried, to be related to unique characteristics of the areas in which they occur. This offers a new set of clues as to the factors involved in a particular change. Efforts of this type in the field of population study have been particularly rewarding, with the result that a whole new area of research has developed. Research in "population distribution," or the study of population phenomena in their environmental and locational context, is coming to be one of the major lines of population analysis.

As a rough illustration of this principle, a few of the major population changes that took place in the United States between 1940 and 1950 will be reviewed in terms of their regional and urban-rural location.

* The research from which this article was developed is a part of a long-range program of research in the field of population distribution, the funds for which were granted by the Rockefeller Foundation. I am indebted to Miss Dorothy Harris, statistician, and to Gracie Van Winkle, Nettie Ulreich, Jane Hartley, Caroline Jefferis, Marie Rohrer and Jean Geiger of the Scripps Foundation staff for the statistical compilations upon which this particular study is based.

When the 1950 census is fully compared with the 1940 census, most population experts probably will rate the following as among the major population changes between 1940 and 1950.

I. *Locational*

1. A continued aggregation of population in urban and metropolitan masses, and the emergence of several new metropolitan and many new urban centers.
2. An extraordinarily rapid growth of suburbs and urban fringes around the small as well as around the larger centers.
3. A large decline in the farm population.
4. A rapid growth of the rural-nonfarm population.
5. An extraordinarily large movement of population to the West Coast states.
6. A rapid urbanization and metropolitanization of the South, particularly along the Gulf Coast and in the Southwest.
7. A marked increase in the concentration of Negroes in urban centers.

II. *Demographic*

8. An increase in the average length of life.
9. A reversal (perhaps temporary) of the downward trend of crude fertility rates.
10. Unusually high rates of spatial mobility, resulting in a change of residence during the decade for a large proportion of the population.

III. *Compositional-locational*

11. A marked change in the age structure of the population.
12. A shift from a predominantly male population to one with a small predominance of females.
13. An emergence of a small but definite growth differential in favor of nonwhites over whites, created by:
14. A marked decline in the number of foreign-born whites among the population.
15. A reduction of unemployment to a very low proportion of the total labor force.
16. An expansion of the labor force, particularly through the greater participation of women.
17. A marked expansion of employment in all white collar occupations, particularly clerical, professional, and managerial occupations, and in craft and operative occupations. A decline of employment in domestic service and farm laborer occupations, and disproportionately small increases in the number of nonfarm laborers.
18. Rapid growth of the construction industry, with above average growth for manufacturing, commerce and transportation industries.

19. Emergence economically of a genuine "middle class" through a fundamental change in the pattern of income distribution.
20. A marked increase in the proportion of the population married, widowed, or divorced, and a corresponding decrease in the proportion of the population that is single. There was a considerable lowering of the average age of marriage during the decade.
21. A marked rise in the average educational attainment of the population, and an increase in the proportion of youths enrolled in school.
22. A greater increase in the number of households than the national rate of population increase, with a consequent reduction in the average number of persons per household.

TABLE I

PER CENT OF INCREASE IN POPULATION OF PRINCIPLE STANDARD METROPOLITAN AREAS, 1940–50, AND PER CENT OF NATIONAL POPULATION IN STANDARD METROPOLITAN AREAS, BY GEOGRAPHIC DIVISIONS, 1950[a]

Geographic Division	Percent Increase 1940–50			Percentage Distribution 1950		
	Total	Metropolitan	Nonmetropolitan	Total	Metropolitan	Nonmetropolitan
United States	14.5	21.3	7.3	100.0	54.1	45.9
New England	10.4	10.5	10.0	100.0	75.7	24.3
Middle Atlantic	9.5	10.2	6.5	100.0	82.7	17.3
East North Central	14.2	18.5	8.5	100.0	58.9	41.1
West North Central	4.0	16.7	–1.3	100.0	33.2	66.8
South Atlantic	18.8	34.9	11.0	100.0	37.3	62.7
East South Central	6.5	27.2	0.3	100.0	27.7	72.3
West South Central	11.3	40.4	1.5	100.0	31.6	68.4
Mountain	22.3	45.3	16.7	100.0	23.1	76.9
Pacific	48.8	51.9	42.1	100.0	70.0	30.0

[a] 125 Standard Metropolitan Areas as of 1940

In the space available, ten of these changes will be documented. The full documentation and interpretation for all of them will be found in two monographs prepared at Scripps Foundation.[1]

1. *Metropolitan and urban aggregation.* Table I shows that in the nation as a whole, the population of metropolitan areas grew almost three times as rapidly as the population of nonmetropolitan areas. Yet the differences among the geographic divisions in this respect are very marked. In the East, metropolitan as well as nonmetropolitan growth tended to be below the national average, and metropolitan

[1] Donald J. Bogue, *Population Growth in Standard Metropolitan Areas, 1900–1950, with an Explanatory Analysis of Urbanized Areas* (Published by the U.S. Government Printing Office for the Housing and Home Finance Agency 1953,) and Donald J. Bogue, *An Analysis of Changes in the Size, Distribution, and Composition of the Population of the United States, 1940–50* (To be published by Scripps Foundation in the series Studies in Population Distribution).

growth was not a great deal higher than nonmetropolitan growth. In the Middlewest and South, metropolitan areas grew rapidly, even though the nonmetropolitan population remained stationary. In the West, both metropolitan and nonmetropolitan rates of growth were above the national average, with the metropolitan being higher than the nonmetropolitan.

The data presented here refer to the 125 standard metropolitan areas of 100,000 or more inhabitants that would have qualified as standard metropolitan areas if the definition had been applied in 1940. In addition, 22 more areas grew to this status during the 1940–50 decade. In 1950, there were 560 more incorporated places of 2,500 or more population (cities) than in 1940. Thus, the metropolitanization and urbanization of the population has proceeded along two fronts: continued growth of existing centers and the creation of additional metropolitan and urban aggregates.

2. *Suburbanization.* The national and regional picture with respect to suburban growth is summarized in Table II. While central cities grew at less than

TABLE II

PER CENT OF INCREASE IN POPULATION FOR THE PARTS OF PRINCIPLE STANDARD METROPOLITAN AREAS, 1940–50, BY REGIONS, STANDARDIZED FOR REGIONAL VARIATIONS IN SIZE OF METROPOLITAN AREA[a]

Region	Parts of Standard Metropolitan Area				
	Total	Central City	Ring Total	Ring Urban[b]	Ring Rural
United States	21.3	13.0	34.7	28.8	41.8
Northeast	10.3	4.1	17.7	12.1	27.9
North Center	18.2	9.8	36.0	35.0	37.3
South	29.9	19.3	62.7	77.2	51.6
West	52.1	31.5	85.7	87.0	91.2

[a] 125 Standard Metropolitan Areas as of 1940

[b] 1940 Definition of Urban

the national average rate, their suburban rings were growing more than twice as fast. Moreover, the rural parts of the ring were growing much faster than the suburban cities.

Here also there was a remarkable variation among regions in this respect. Differences among regions in the level of growth of their standard metropolitan areas are reflected in the rates of growth of all the parts. In addition, the tendency toward peripheral growth was much greater in the Northeast than in the South and West. Similarly, the tendency for suburban growth to be an expansion into rural territory was more pronounced in the Northeast than elsewhere. In the South and West the urban population of the ring tended to grow about as rapidly as the rural part.

3. *Exodus from farms.* Within the decade the rural-farm population, as defined by the Census Bureau, declined by 23.6 per cent. A small part of this re-

ported shift represents a change in the Census definition of what constitutes the farm population. That the farm population suffered a decline of about one-fifth during a decade when the nation was growing fairly rapidly is indeed a striking phenomenon.

Although this change was evident in all divisions, it varied considerably from one division to another. The tendency to forsake farms was greater in the South, Southwest, and New England areas than elsewhere. It was least in the Pacific states and in the North Central states. Rapid mechanization, farm consolidation, and the abandonment of sub-marginal farms are reflected in this shift.

4. *Growth of the rural-nonfarm population.* Table III reports that while the

TABLE III

PER CENT CHANGE IN POPULATION OF GEOGRAPHIC DIVISIONS, BY URBAN-RURAL RESIDENCES AND COLOR 1940–50

Residence and Color	Geographic Division									
	U.S. Total	New Eng.	Mid. Atlan.	E.N. Cent.	W.N. Cent.	So. Atlan.	E. So. Cent.	W. So. Cent.	Mountain	Pacific
Total Population	14.5	10.4	9.5	14.2	4.0	18.8	6.5	11.3	22.3	48.8
Urban[a]	19.5	7.8	7.1	14.6	17.1	30.0	28.9	48.0	39.8	43.3
Rural	7.9	18.6	17.6	13.4	−6.4	11.8	−2.8	−13.0	9.3	59.3
Rural-nonfarm	43.2	35.5	32.0	45.8	16.3	55.2	42.8	28.2	35.9	99.5
Rural-farm	−23.6	−28.7	−20.3	−19.0	−20.2	−23.2	−23.1	−36.1	−21.7	−11.1
White	14.1	10.0	7.6	11.8	3.5	22.5	9.7	13.9	21.8	46.5
Urban[a]	17.2	7.2	4.5	11.1	16.3	30.9	31.2	51.1	38.9	39.7
Rural	10.0	18.7	17.5	13.1	−6.3	17.1	1.2	−11.4	8.5	59.4
Rural-nonfarm	43.4	35.7	31.9	45.5	16.4	59.6	46.6	26.9	32.8	97.3
Rural-farm	−22.5	−28.5	−20.3	−19.0	−20.0	−22.2	−21.6	−34.8	−21.0	−9.8
Nonwhite	17.1	41.8	47.9	69.1	19.7	8.7	−2.8	0.2	34.1	109.0
Urban[a]	43.5	48.0	50.3	72.1	32.6	27.4	22.9	33.5	84.7	134.0
Rural	−7.3	5.3	26.4	41.3	−11.7	−2.9	−15.0	−19.6	21.8	58.1
Rural-nonfarm	40.4	22.4	35.2	60.8	9.9	38.7	25.8	35.5	111.0	201.8
Rural-farm	−29.8	−62.4	−26.0	−22.2	−34.0	−25.3	−27.1	−40.6	−29.7	−32.5

[a] 1940 Definition of Urban

rural-farm populations declined, the rural-nonfarm population, with the urban and rural-nonfarm populations defined as in the 1940 census, increased by more than 40 per cent. Actually, this is not a growth of open-country villages and hamlets. Instead, it is a reflection of the trend toward suburbanization. The tendency toward suburban growth is so prevalent that many hundreds of small towns and villages now have tiny suburban fringes, even before they become large enough to be classified as cities by the census. Because the population of these fringes lies outside corporate city limits, the census classifies it as rural-nonfarm. In the vicinity of larger cities, much of this fringe settlement is now so compact and fully built-up that it really lives under urban conditions, by whatever objective standard one might

choose. This urban-like fringe is growing so rapidly, and has now reached such a size, that it threatened to render meaningless the census definitions of urban and rural. Accordingly, in 1950 the census definition of urban population was changed to include the densely settled portion of urban fringes around cities of 50,000 or more inhabitants. To further separate the genuinely urban from the rural population, the census defined as urban all densely settled unincorporated places of 2,500 or more, even if they were located away from metropolitan centers. Together, these changes in the urban definition removed more than 7.5 million people from the rural (principally rural-nonfarm) and added them to the urban category[2]. If it is assumed that all of the population so transferred came from the rural-nonfarm category, even with this huge loss of numbers through a change in definition, the rural-nonfarm population grew at slightly greater than the national rate. Although it will be difficult to measure the total amount and locate precisely, there is unmistakable evidence of rural-nonfarm population growth around cities of all sizes. Much of this takes the form of relative scattered settlement along main highways, but in the vicinity of towns. This general trend also has a regional pattern. Since it follows rather closely the regional pattern of metropolitan and urban concentration, a separate table is not shown for it here.

5. *Westward movement.* In Tables I, II, and III it is evident that the West grew at a very rapid rate. To increase its population by almost 50 per cent in ten years it was necessary for the Pacific division to attract a larger number of migrants than during any previous decade in its history. A striking aspect of this movement worthy of particular note is that almost none of it was a movement to settle land. The rural-farm population of the west actually declined during the decade. The growth occurred principally in metropolitan areas, especially in the rings of metropolitan areas. Hence, by 1940, the period of net gain through settlement of land for agricultural purposes appears to have been ended in the West as it was elsewhere in the nation.

6. *Metropolitanization and urbanization* of the South. Except for Florida, Virginia, and Texas, all states of the South grew at rates below the national average, and three of the states actually lost population. In spite of this fact, there was rapid urbanization and metropolitan growth throughout all three divisions of the South, at rates more than twice the national average (Tables I and III). In order to accomplish this, it was necessary that much of the rural-farm population decline be absorbed by the developing urban centers. Thus, the South appears to have been building its metropolitan centers and other cities primarily by rearranging its own population rather than by attracting population from other regions.

[2] This change in the definition of the urban population, while necessary, poses a difficult problem of comparing data from the 1950 census with statistics from earlier censuses. The Census Bureau has published a special tabulation for selected characteristics which makes it possible to compare 1950 and 1940 data in terms of the *old* (1940) definitions of urban and rural. There appears to be no easy way of adjusting the 1940 statistics to match the *new* (1950) definitions, however. Hence, much of the urban growth, by the new definition, is reported as rural-nonfarm (and some rural-farm) growth by the old definition.

7. Concentration of nonwhite population in urban centers. From Table III it is evident that the rate of exodus from farms was greater for the nonwhite population than for the white. This was true for all geographic divisions. Literally thousands of nonwhites (mostly Negroes) left the soil to settle in urban centers. The result was almost a doubling of the nonwhite population of cities within the decade.

If the rates of urban growth for whites and nonwhites are compared, by divisions, it appears that a very large proportion of the nonwhites migrated to northern cities, while their white neighbors tended more to settle in southern cities as well. For each two nonwhite residents in cities of the Northeast in 1940 there was a third nonwhite resident in 1950, while on the West Coast the number of nonwhite residents more than doubled, in spite of the scattering of the Japanese population among other divisions during the war.

TABLE IV

CRUDE BIRTH RATE PER THOUSAND RESIDENTS, 1940 AND 1950, AND PER CENT CHANGE IN RATE 1940–50

Geographic Division	Crude Birth Rate		
	1940	1950	Percent Change
United States	19.43	24.10	24.03
New England	15.91	20.96	31.74
Middle Atlantic	15.60	20.67	32.50
East North Central	17.65	23.67	34.11
West North Central	18.37	24.01	30.70
South Atlantic	24.15	26.33	9.03
East South Central	25.43	27.51	8.18
West South Central	23.80	27.25	14.50
Mountain	24.04	28.82	19.88
Pacific	16.58	23.45	41.44

8. Suspension of the decline in fertility. Table IV shows the births per thousand residents in 1940 and in 1950 for the nation and each geographic division. Instead of the continued decline which had been forecast for it, in 1950 the crude birth rate was greater than in 1940 by almost one-fourth. It has been at about this level for almost a decade now, in defiance of all arguments that it will suffer a precipitous drop and then resume its predicted downward course. An examination of the rate, and change in rate, for each division shows that the greatest upswing in fertility has taken place in precisely those areas where it was lowest in 1940. The areas which traditionally have had high fertility rates had a much smaller rise in their birth rate. Because the more industrialized and urbanized areas were the ones that had low birth rates in 1940, it is the urban areas, rather than the rural areas, that have been the primary source of the "baby boom." It should be noted that in this process of arriving at a more uniform birth rate for the entire nation,

such deviations as exist are the same as those of 1940; the Northeast, North Center, and Pacific states were below the rate for the nation in both 1940 and 1950, and the remainder of the divisions were above it, in both decades.

TABLE V

PER CENT CHANGE IN THE POPULATION OF THE UNITED STATES AND GEOGRAPHIC DIVISION BY AGE AND URBAN AND RURAL RESIDENCE, 1940–50

Type of residence and age	Geographic Division									
	U.S. Total	New Eng.	Mid. Atlan.	E.N. Cent.	W.N. Cent.	So. Atlan.	E. So. Cent.	W. So. Cent.	Mountain	Pacific
All areas	14.5	10.4	9.5	14.2	4.0	18.8	6.5	11.3	22.3	48.8
0–9	38.3	40.3	37.8	44.2	24.9	33.8	16.7	26.5	42.6	112.2
10–19	−9.7	−16.5	−19.1	−10.5	−15.7	−5.2	−9.8	−10.4	2.8	22.6
20–29	4.6	2.0	−1.3	5.6	−5.0	8.6	−4.8	1.1	11.5	37.6
30–39	15.0	14.5	9.6	14.5	1.3	24.1	4.9	5.8	27.5	50.9
40–49	13.1	3.5	6.3	7.5	0.2	26.9	16.3	19.4	21.6	39.0
50–59	18.4	14.5	18.1	15.7	7.0	26.8	13.8	21.9	16.2	33.0
60–69	29.6	19.3	30.3	30.4	19.7	31.1	20.5	29.7	36.8	50.6
70 & over	39.4	32.1	37.5	32.6	25.9	52.7	42.5	53.3	44.1	56.6
Urban[a]	19.5	7.8	7.1	14.6	17.1	30.0	28.9	48.0	39.8	43.3
0–9	54.6	36.7	34.8	46.6	50.3	63.1	64.7	94.7	75.8	109.8
10–19	−9.1	−20.5	−22.3	−13.5	−6.6	−0.5	3.6	17.3	14.3	14.4
20–29	10.2	−0.4	−4.1	6.2	11.8	17.7	19.9	39.5	30.7	31.8
30–39	15.4	10.6	4.7	11.2	7.5	25.7	17.0	31.9	39.2	41.2
40–49	14.1	0.4	3.6	6.5	8.2	33.0	30.3	46.9	33.4	34.3
50–59	25.1	14.7	19.1	20.5	19.7	41.2	34.9	55.3	33.1	32.3
60–69	39.9	21.3	33.2	40.9	37.6	48.2	43.7	65.1	53.5	50.3
70 & over	49.1	34.4	41.1	42.5	41.4	71.2	68.8	90.8	63.0	58.2
Rural-nonfarm	43.2	35.5	32.0	45.8	16.3	55.2	42.8	28.2	35.9	99.5
0–9	72.6	70.5	61.5	82.1	39.6	78.7	61.0	49.4	56.2	169.5
10–19	18.7	9.3	−0.2	22.5	−5.0	27.2	23.7	12.3	20.4	75.4
20–29	32.1	26.7	22.4	38.7	2.9	44.1	28.4	10.8	19.6	87.1
30–39	43.9	41.6	39.6	47.4	11.2	58.4	35.0	13.2	39.0	105.0
40–49	42.2	29.1	31.9	41.7	11.3	60.7	51.3	33.2	36.5	82.8
50–59	40.3	32.8	32.6	37.6	18.8	58.8	47.9	38.5	28.4	67.5
60–69	50.2	33.8	42.1	42.8	32.7	65.5	60.4	51.0	53.9	91.8
70 & over	61.2	48.2	49.2	47.2	39.5	94.6	94.8	82.9	58.9	94.9
Rural-farm	−23.6	−28.7	−20.3	−19.0	−20.2	−23.2	−23.1	−36.1	−21.7	−11.1
0.9	−15.9	−9.3	0.7	−2.4	−6.8	−19.5	−20.1	−33.7	−12.8	15.0
10–19	−31.9	−37.3	−32.3	−29.5	−30.3	−30.2	−28.3	−42.9	−29.6	−23.1
20–29	−39.6	−39.4	−29.3	−34.1	−34.9	−39.3	−40.9	−53.7	−35.3	−29.4
30–39	−19.0	−20.8	−9.3	−9.6	−15.2	−16.6	−22.9	−37.2	−12.7	−2.6
40–49	−18.0	−29.5	−23.1	−20.9	−18.2	−13.5	−11.5	−24.8	−17.6	−9.4
50–59	−19.1	−31.6	−24.9	−19.9	−17.2	−16.4	−14.9	−23.7	−24.3	−14.0
60–69	−14.7	−32.5	−21.0	−13.6	−14.4	−13.3	−10.2	−18.9	−11.9	−8.2
70 & over	−9.3	−26.6	−17.7	−13.5	−14.6	0.9	3.3	−8.7	−18.1	−16.6

[a] 1940 definition of urban

9. *Changes in the age structure of the population.* The age structure of a population and change in age structure are a function of fertility rates, the ages to which people live, and migration. For several decades prior to 1940 these three factors had conspired to cause a steady and marked increase in the number and proportion of population in the older ages. The combined effect of these processes is unmistakable from Table V. From a decline of almost 10 per cent in the age group 10–19 years, with increasing age there is an almost unbroken rise in the rate of

TABLE VI

PER CENT CHANGE IN EMPLOYMENT IN THE UNITED STATES AND GEOGRAPHIC DIVISION, BY SEX, COLOR, AND URBAN-RURAL RESIDENCE, 1940–50

Employed, by sex and type of residence	Geographic Division									
	U.S. Total	New Eng.	Mid. Atlan.	E.N. Cent.	W.N. Cent.	So. Atlan.	E. So. Cent.	W. So. Cent.	Mountain	Pacific
All, areas, both sexes	24.5	18.0	21.1	28.3	18.6	23.2	12.6	20.5	38.5	51.0
Urban[a]	30.2	16.7	19.1	29.5	33.4	30.7	34.7	55.1	60.5	47.1
Rural-nonfarm	50.8	39.1	41.6	62.8	37.1	53.9	48.6	33.9	49.2	91.0
Rural-farm	−17.0	−24.2	−13.2	−10.8	−11.6	−17.0	−20.2	−31.2	−11.4	−4.2
White male	19.1	14.5	15.4	19.3	11.6	21.5	14.0	17.8	29.6	40.6
Urban[a]	24.0	13.3	13.6	20.7	28.8	26.7	35.6	54.9	53.1	36.5
Rural-nonfarm	48.2	36.8	37.3	56.7	35.3	55.2	54.1	33.3	40.0	78.9
Rural-farm	−17.7	25.6	−17.1	−15.8	−15.7	−16.1	−16.0	−29.6	−14.3	−7.5
Nonwhite male	18.9	56.0	78.4	122.8	40.1	7.7	−8.5	−5.0	32.7	73.6
Urban[a]	60.5	67.4	82.6	127.0	56.0	33.7	26.7	42.7	97.5	103.2
Rural-nonfarm	34.1	8.1	41.0	70.8	24.7	32.4	15.6	26.8	88.2	146.5
Rural-farm	−32.8	−60.8	−9.6	−3.5	−28.8	−26.3	−32.2	−45.6	−23.6	−34.0
White female	44.3	24.6	27.6	43.9	41.7	55.8	56.7	65.6	77.2	75.9
Urban[a]	38.0	21.9	22.2	35.9	40.0	48.4	56.2	77.2	76.8	61.7
Rural-nonfarm	68.5	45.9	53.6	84.9	43.6	77.4	75.8	54.7	79.3	118.3
Rural-farm	25.2	−15.1	12.3	37.4	40.3	17.0	20.2	12.3	42.1	45.8
Nonwhite female	22.0	60.4	67.2	131.7	53.3	6.6	−9.8	1.2	31.6	160.7
Urban[a]	39.7	74.7	69.9	133.3	59.0	12.7	8.9	12.9	98.5	170.6
Rural-nonfarm	21.1	−10.1	19.4	82.6	3.4	22.0	7.8	7.0	103.8	219.4
Rural-farm	−36.5	−52.4	3.1	5.4	−0.1	−27.3	−44.6	−44.2	−48.6	−17.9

[a] 1940 definition of urban

growth between 1940 and 1950 to a high of 39.4 per cent for people 70 years old and over. The number of persons 60 years old and over increased at more than twice the national rate.

Incidentally, the rapid growth of the 0–9 year age group is an index of the impact of the baby boom upon the total population, and points out just how completely the older fertility trend was altered.

Although the change in age structure of the nation was followed by each geographic division in general, there was considerable deviation. The industrial North-

east and North Center, where fertility had declined to the lowest point, and where the aging of the population had already proceeded farther, had greater rates of decline in the 10–19 years group and smaller rates of growth for the aged population than the balance of the nation. Although the rapid growth of the Pacific division has been reputed to be heavily weighted with older people seeking retirement, the data here suggest that after the normal aging process is taken into account, the 1940–50 migration would appear to have been primarily a movement of young adults and families with children. The movement into the South Atlantic and South Central divisions, however, may have contained a higher proportion of older people settling along the Atlantic and Gulf coasts.

Table V also shows that the urban and rural changes described above were not evenly spread among all age groups. The decline in the farm population, for example, was much greater among the young people 20–29 than among older or younger ages. It may appear that one major source of decline among the farm population is the failure of young people to return to the farm after their release from military service.

10. *Expansion and geographic redistribution of the employed labor force.* While the population of the United States was increasing 14.5 per cent, according to Table VI, the size of the nation's employed labor force increased 24.5 per cent. This greater increase in the number of people with jobs was caused by the higher level of prosperity and by the much greater participation of women than before the war. Whereas the employed male labor force increased by about 9 per cent, the number of white females in the labor force increased by 44 per cent.[3]

Although the growth of the labor force of each geographic division, and of urban and rural areas, is in part a reflection of the population changes in those areas, there are also variations which appear to reflect other factors. The Pacific division, for example, failed to increase its employment level much above the level of its population growth. On the other hand, the industrial states of the East and North Center appeared to have been unusually successful in increasing the number of jobs above what one would expect on the basis of population growth alone. In all divisions, the extra increase, above the level of population growth took place largely in urban areas. The rural-farm labor force declined in all divisions.

CONCLUSION

Even such a hasty introduction as this to some of the major population changes that occurred between 1940 and 1950 should serve to demonstrate that in no single geographic division did the changes closely parallel those of the nation. The deviations from the national trend appear to be reflections of fundamental changes which were taking place within the geographic division. With national changes of 30,

[3] The rates shown for the urban and rural-nonfarm employed labor force are only approximate. The 1950 data are reported only for the new definition of urban and rural. Using average correction factors for persons 15 years of age or more by sex, color, and region the 1950 data have been adjusted to match the old definitions. Also, the 1940 data include military personnel stationed in the United States, whereas the 1950 data refer to civilian employment only.

50, and even 100 per cent confronting us and with some of them being reversals of earlier trends, it is evident that all of us must relearn the population lore for the United States, and that we must relearn it in terms of regions, subregions, and even smaller units of area if possible. We must place less blind faith on the permanence of "trends" and undertake to find out what lies behind them.

As was suggested in the introduction, the demographers who will place the most valid and lasting interpretation upon this remarkable set of population changes probably will not be those who operate at the broad national level, but will be those who insist upon breaking the nation into its parts and who relate population changes to environmental changes. It was for exactly this kind of research task that the system of economic regions, economic subregions, and state economic areas was invented. And it is because of the growing realization that the geographical point of view is a most fruitful one that the idea has taken root and is growing.

This development in the field of social statistics should be of particular interest to geographers, and one in which they should feel impelled to assist. It is not, as some who have encountered it have thought, an invasion of the geographer's domain by the statistician. Instead, it represents an acceptance of the fundamental point of view of human geography, and an earnest attempt to employ that point of view in statistical analysis.

Accepted October 1953

POPULATION PATTERNS IN TROPICAL AFRICA*

GLENN T. TREWARTHA AND WILBUR ZELINSKY
University of Wisconsin

INTRODUCTION

DURING recent years there has been a slowly growing realization that population numbers and characteristics constitute a pivotal element in geographic studies.[1] At the same time, the number and quality of population maps available to the geographer have generally remained altogether inadequate for his needs. The lack, or inadequacy, of census materials is an excuse that applies to a rapidly diminishing sector of the world; and, even there, the determined population mapper can exercise his ingenuity so as to transcend the limitations of poor enumerations.[2] The fact that, outside parts of Europe and North America and a few scattered sections of Asia, most regions lack usable, up-to-date population maps, or have been represented at unsatisfactory scales with poor symbolism, is evidence merely of inertia and the scarcity of population mappers, not of the absence of a need for superior maps.

Although the promotion of any such ambitious plan as a 1 : 1,000,000 population map of the world may not be feasible at the present time because of its great cost,[3] the authors feel that the time is ripe for the initiation of a population atlas of the world in which map scale, the number of topics treated, and the textual detail for each region would depend both on the quality of available material and the size and complexity of its population. Indeed, it seems unlikely that such an enterprise can be delayed many more years as the ever more serious social and economic implications of population force themselves upon the attention of scholars and statesmen.

The population maps of tropical Africa, and the discussion thereof offered here, represent a tentative step in the direction of such a world atlas; but this initial effort is by no means to be regarded as an adequate sample of what is sought in the format of the larger work. Considering the general inadequacy of the data and especially their highly variable quality from one political unit to another, this survey does represent approximately the maximum utilization of the published data at the least common denominator level. Avoiding for the present moment the large scales, profusion of subject matter, and sophisticated symbolism possible for well-

* The work was supported in part by a grant from the Special Research Fund of the University of Wisconsin.

[1] Glenn T. Trewartha, "A Case for Population Geography," *Annals of the Association of American Geographers,* XLIII (1953): 71–97.

[2] E.g., R. W. Steel, "The Population of Ashanti: a Geographical Analysis," *Geographical Journal,* CXII (1948): 64–77, in which the author manages to construct a map of population distribution from general maps of the country far superior to those possible using only census data.

[3] This proposal and alternative suggestions are examined in detail in International Geographical Union, *Report of the Commission for the Study of Population Problems.* International Geographical Congress, Washington, 1952.

tabulated nations, the authors have decided to exploit the sub-standard materials available on Africa so as to attempt to close one of the larger gaps in the population map coverage of the world.

The likelihood that the distribution of population in tropical Africa is more poorly known and understood than that of any other equally extensive, inhabited portion of the world is a factor that strongly recommends the region to the immediate attention of the population geographer. Before the detailed plotting of its population data was undertaken, only the grossest elements of pattern were available in the few small-scale atlas plates and the single wall-map on the subject, and even some of these elements subsequently proved to be inaccurate. In a few cases—those of Richard-Molard and Urvoy in parts of French West Africa, Gourou in Ruanda-Urundi and the Belgian Congo, and Gillman in Tanganyika[4]—first-rate maps of individual countries have been produced at larger scales utilizing to the limit the far from ideal published and unpublished data.[5] Elsewhere whole colonies have gone unmapped, or the existing medium-scale maps are nearly all stop-gap approximations. The construction of Figures 1a, 1b, then, involved something of the excitement and suspense of an exploratory journey, as many previously vague or unknown population regions took shape.

MAJOR LINEAMENTS OF DISTRIBUTION[6]

Tropical Africa, as defined in Figures 1a, 1b excludes the dry tropics—the regions to the north of the 17°N parallel, the Somaliland colonies, South-West Africa, and Bechuanaland—because of the thinness and nomadic behavior of their population and also because of the inadequacy of their statistics. The reason for the omission of Ethiopia and the Anglo-Egyptian Sudan is the almost total absence of population data for these countries.

Where population data are available for tropical Africa (Appendix II), they are universally characterized by meagerness of detail and relative unreliability, as compared to the census material published by the more advanced nations of Europe and America.[7] As a matter of fact, no sizeable portion of the region has ever undergone a truly detailed and systematic enumeration using well-trained personnel, i.e., what might be termed a scientifically conducted census. Such a procedure is

[4] See Appendix I for a list of the important population maps of tropical Africa.

[5] The following unpublished population maps of parts of tropical Africa by seminar students of the senior author may also be mentioned.

Gold Coast, 1:1,000,000, Glenn V. Fuguitt
Kenya, 1:1,000,000, D. C. Multauf
Nyasaland, 1:500,000, Gene E. Musolf
Uganda, 1:1,000,000, Robert Reece
French Guinea, 1:2,000,000, Reginald Marshall

[6] Figs. 1a and 1b are similar, but not identical in their coverage. The choropleth map, 1a, involves the entire population, rural as well as urban and non-African as well as African. The dot map, 1b, includes rural African population only, but this is approxmiately 93 per cent of the total.

[7] This point is made repeatedly in the literature on Africa but most emphatically and with greatest detail in R. R. Kuczynski, *Demographic Survey of the British Colonial Empire. Volume I. West Africa,* (London, 1948) and *Volume II. East Africa, Etc.,* (London, 1949).

rendered difficult, if not impossible, by the prevalence of illiteracy, distrust of the enumerators' motives, and a weak sense of time and number among the African population. Instead, estimates have been based on sample surveys, extrapolations from tax lists, counts compiled with the aid of untrained or semi-trained native African officials, and, in certain extreme cases, simple reconnaissance. The result is that there is a large probable margin of error in all African population counts—generally, it appears from the available evidence, on the side of under-enumeration.[8] The size of this error is such that it masks any discontinuities that might be introduced into Figures 1a, 1b by the use of material that varies in publication date by as much as a decade from country to country. The most that can be hoped for from these statistics is that the degree of error does not vary too greatly regionally and that their synthesis in Figures 1a, 1b affords a moderately good picture of relative distribution, if not of absolute number.

Except for the details of non-African population, which apparently have been recorded with considerable fidelity, the situation is even less satisfactory when demographic phenomena other than simple numbers are dealt with. It is stretching the data almost beyond their limits to treat the statistics of rural and urban residence and sex ratio even by national units; but such major topics as fertility, mortality, population change, migration, age structure, marital status, and employment must be almost wholly ignored in this study because of a complete lack of material in many countries and a decided incompatibility of data along international boundaries in other cases. Particularly unfortunate is our inability to construct a time series of population maps, or even graphs, for tropical Africa to illustrate the vitally important phenomenon of regional variations in the rate and amount of population change.[9] Nevertheless, despite all the reservations that must be made concerning the quality of the data, it should also be indicated that their volume, reliability, and detail have markedly increased during the past decade or two and that it should be possible to compile a much improved population map of tropical Africa within a few years. The impending publication of the 1952–1953 Census of Nigeria and the initiation of the first Liberian census, which is scheduled for 1954–1955, are perhaps the most notable of the imminent steps in a gradually improving situation.[10]

[8] For more explicit information on data sources see Appendix II and the inset map on Fig. 1b.

[9] The problem of population change in Africa during the Twentieth Century has been dealt with in some detail in L. T. Badenhorst, "Population Distribution and Growth in Africa," *Population Studies,* V (1951) : 23–34. His table (p. 34) showing estimated change by country indicates relatively rapid increases for most areas, but it is highly uncertain how much of this apparent growth is actual and how much should be attributed to improved methods of enumeration.

[10] The statistical data used for the maps accompanying this article were the latest available to the authors at the time of writing (July, 1953). During their current research on the population geography of Africa, a considerable volume of previously inaccessible as well as more up-to-date statistical material has been acquired. It has been possible to revise Tables I through IV so as to utilize this new information; but time has been lacking for the revision of the maps. Consequently, any discrepancies that may be noted between maps and tables can be ascribed to the more recent date of the latter.

Not the least of the obstacles in the compilation of a detailed population map of tropical Africa is the inadequacy and defectiveness of base maps depicting administrative subdivisions and the meagerness and ureliability of published figures on their areas. It has, moreover, been necessary to exercise ingenuity merely to identify some administrative areas, and the boundaries of a great many of those shown in Figure 1a are rough approximations only. One of the prime causes of these difficulties, it might be explained, is the ephemeral nature of many administrative boundaries in colonial Africa, for the boundaries, areas, and names of small political subdivisions appear to be in constant revision. A problem corollary to that of poor base maps is the lack of any general map coverage for tropical Africa at a scale larger than 1 : 1,000,000. Where map series of a larger scale have been published, as in the case of Nigeria, the Gold Coast, Ruanda-Urundi, portions of French West Africa, and scattered areas elsewhere,[11] it is possible, by consulting them, to plot population distribution with a relatively high degree of accuracy.

After the compilation of a base map at the smallest scale permitting adequate utilization of available statistical material, another serious problem had to be resolved : the choice of a system of population symbolism.[12] The choropleth technique has been employed on a map (Fig. 1a) where population densities are shown in eleven categories by the smallest mappable administrative divisions. The inherent limitations of the choropleth technique, the fact that political boundaries are particularly arbitrary and meaningless population-wise, and the weakness of areal statistics made it seem advisable to use a second map which would remedy some of the deficiencies of Figure 1a by employing the dot technique (Fig. 1b). This method is one of such flexibility that it can exploit precise, detailed data to the limit, where any are available, and yet be used to represent population in areas for which knowledge of population numbers and location is highly uncertain. In the case of Figure 1b, the accuracy of dot location was determined by the reliability of population data and the quality of existing general maps and population maps and thus varies considerably from country to country.[13]

The best possible representation of African population at the scale here used would be by means of the dasymmetric method or some combination of dasymmetric symbols with a dot system. Unfortunately, the technique of plotting actual tracts of relatively homogenous density, without reference to political lines, by detailed analysis of large-scale general maps of culture or unusually accurate dot maps, is wholly out of the question at the present time for more than a few sections of tropical

[11] Cf. Raye R. Platt, "Official Topographic Maps: a World Index," *The Geographical Review,* XXXV (1945) : 175–81.

[12] For a discussion of the relative merits of various systems of mapping population, see C. B. Fawcett, "Population Maps: a Discussion . . . ," *Geographical Journal,* LXXXV (1935) : 142–159, John K. Wright, "A Method of Mapping Densities of Population," *The Geographical Review,* XXVI (1936) : 103–110, Arthur H. Robinson, *Elements of Cartography.* New York, 1953. pp. 161–90, and F. J. Monkhouse and H. R. Wilkinson, *Maps and Diagrams.* London, 1952. pp. 217–80.

[13] See inset, Figure 1b and Appendices.

Africa. Figure 1, then, represents a compromise, in terms of symbolism, between what is ideal in a population map and the techniques possible with limited data. The dot equivalent of 2,500 persons chosen for Figure 1b is the smallest possible at

TABLE I.

POPULATION DENSITY, BY COUNTRY
NUMBER OF PERSONS PER SQUARE KILOMETER

Country (in order of density)	(Date)	Population (1,000's)	Area (1,000's of km.²)	Density
Zanzibar	1950	264	3	88.0
Ruanda-Urundi	1950	3,909	53	73.8
São Tomé and Principé	1950	60	1	62.0
Nigeria	1952–53	31,193	771	40.3
Sierra Leone	1948	1,975	72	27.4
Gambia	1951	252	11	22.9
Uganda	1952	5,200	243	21.4
Gold Coast	1951	4,340	204	21.3
Nyasaland	1950	2,469	123	20.1
French Togoland	1952	1,030	55	18.7
Liberia	1949	1,648	111	14.9
Portugese Guinea	1950	511	36	14.2
Dahomey	1951	1,570	113	13.7
Haute Volta	1951	3,116	214	11.4
Senegal	1951	2,093	209	10.0
Kenya	1949	5,454	583	9.4
Tanganyika	1952	7,787	939	8.3
French Guinea	1951	2,257	275	8.2
Madagascar	1952	4,464	590	7.6
Mozambique	1950	5,733	771	7.5
French Cameroons	1951	3,077	432	7.1
Spanish Guinea and Fernando Po	1950	199	28	7.1
Ivory Coast	1951	2,170	319	6.8
Southern Rhodesia	1951	2,146	389	5.5
Belgian Congo	1951	11,661	2,344	4.9
Angola	1950	4,145	1,247	3.3
French Sudan	1951	3,445	1,193	2.9
Northern Rhodesia	1951	1,741	752	2.3
Niger	1951	2,165	1,281	1.7
French Equatorial Africa	1951	4,435	2,510	1.7
Mauritania	1951	546	1,078	0.5
Total		121,055	16,950	7.1

its scale if the dot is to be legible and if only the very densest areas are to become completely black.

The greater part of the following discussion of population distribution in tropical Africa is derived from a study of Figures 1a and 1b. A brief glance at these sources discloses the fact that tropical Africa can readily be divided into three major popu-

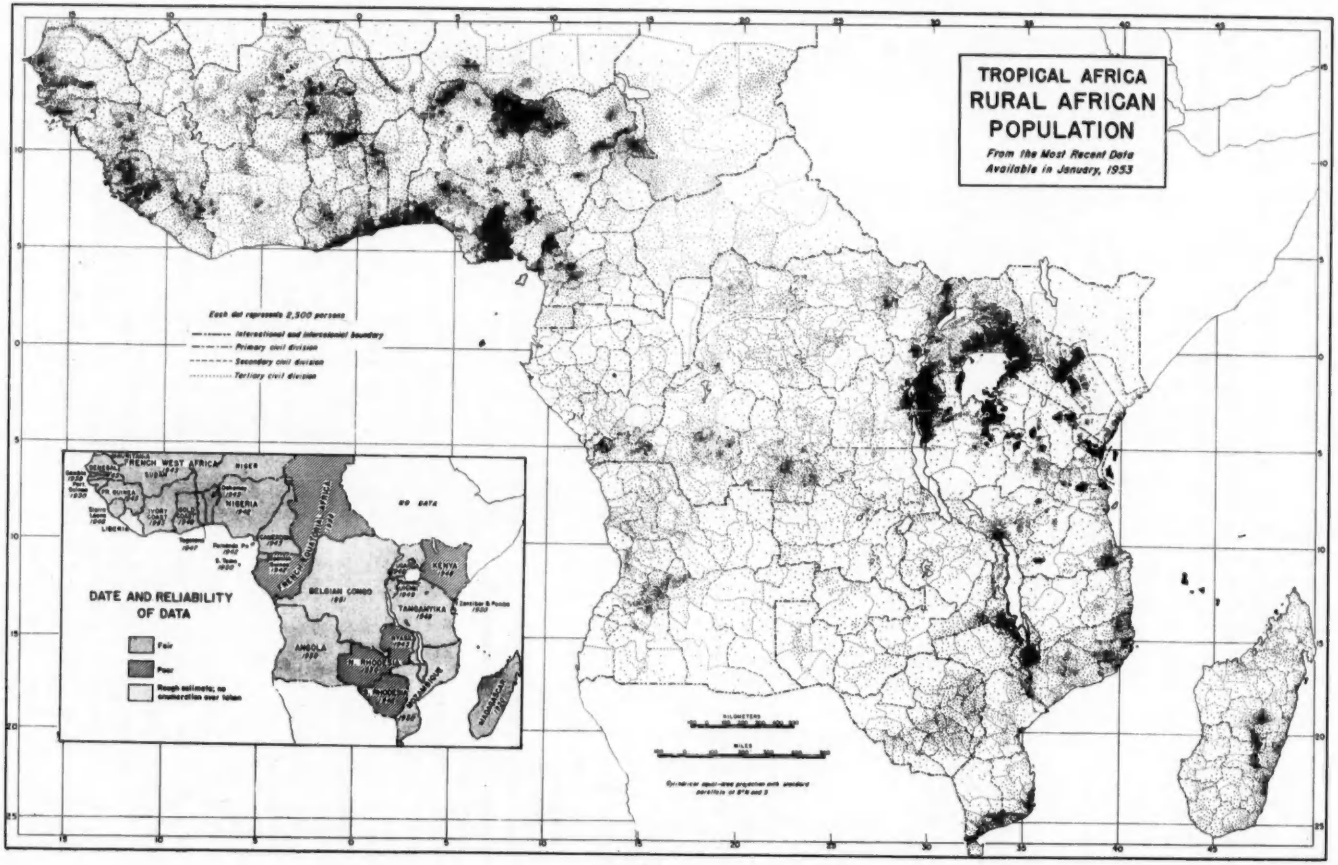
TROPICAL AFRICA
RURAL AFRICAN
POPULATION
From the Most Recent Data
Available in January, 1953
Each dot represents 2,500 persons
International and intercolonial boundary
Primary civil division
Secondary civil division
Tertiary civil division
DATE AND RELIABILITY
OF DATA
Fair
Poor
Rough estimate; no enumeration over taken
NO DATA
FRENCH WEST AFRICA
NIGERIA
BELGIAN CONGO
KENYA
TANGANYIKA
ANGOLA
RHODESIA
KILOMETERS
MILES

FIG. 1a.

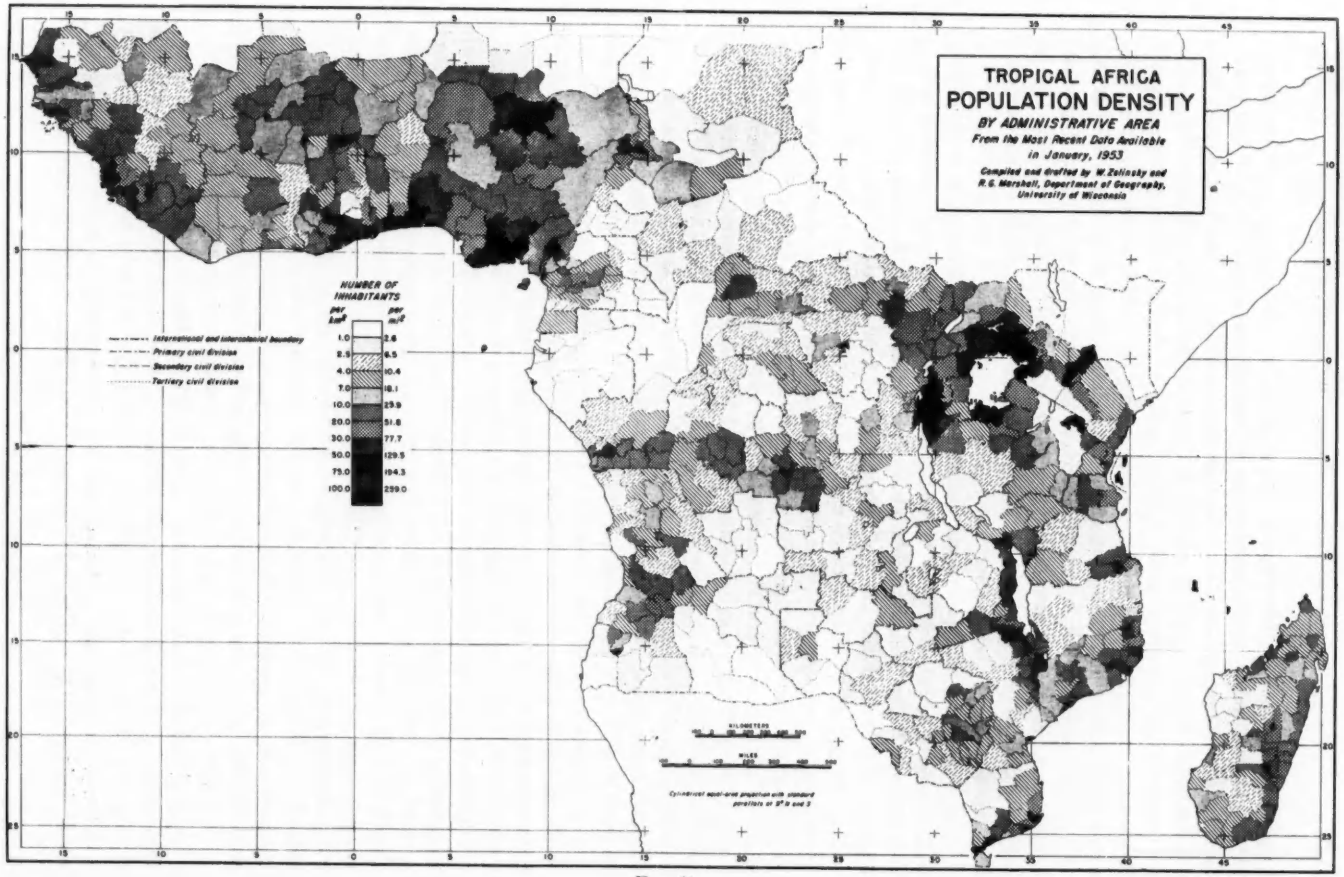
TROPICAL AFRICA
POPULATION DENSITY
BY ADMINISTRATIVE AREA
From the Most Recent Data Available
in January, 1953
Compiled and drafted by W. Zelinsky and
R. E. Marshall, Department of Geography,
University of Wisconsin
NUMBER OF INHABITANTS
per km²
per mi²
1.0 2.6
2.5 6.5
4.0 10.4
7.0 18.1
10.0 25.9
20.0 51.8
30.0 77.7
50.0 129.5
75.0 194.3
100.0 259.0
International and intercolonial boundary
Primary civil division
Secondary civil division
Tertiary civil division
KILOMETERS
MILES
Cylindrical equal-area projection with standard parallels at 9° N and S

FIG. 1b.

lation regions: 1) a relatively dense West Africa-Sudan area (average population density about 11 persons per km.²) which includes the western portion of the French Cameroons, the northern section of French Equatorial Africa and all the lands westward therefrom; 2) a sparsely populated Central African area (average density 3.4 persons per km.²) embracing the remainder of the French Cameroons and French Equatorial Africa, the Belgian Congo excepting its northeastern parts, and the whole of Spanish Guinea, Angola, and the Rhodesias; and 3) an East African area (average density 10.3 per km.²) characterized by a complex alternation of high and low densities in which are included Kenya, Tanganyika, Uganda, Ruanda-Urundi (along with the bordering section of the Belgian Congo), Nyasaland, Zanzibar, Mozambique, and Madagascar.

The West Africa-Sudan region is distinguished by the highest *average* population density to be found in tropical Africa, and by a relatively intricate areal pattern of population. The bulk of its inhabitants live within three large, discontinuous sub-regions: a) a belt running along the Guinea Coast from the Gold Coast to the southwestern corner of the French Cameroons and extending inland some 100 to 200 kilometers; b) an east-west Sudanese belt paralleling the first and stretching from southeastern French Sudan and northern Ivory Coast and Gold Coast across northern Nigeria to the northern Cameroons and, in somewhat attenuated fashion, further eastward into Tchad; and c) another coastal belt extending from western Senegal southeastward into Sierra Leone. If, in turn, each of these sub-regions is analyzed, it will be found to consist of a quite irregular mixture of areas of widely varying population densities. Within these three sub-regions densities range from a minimum of 10 per km.² (26 per sq. mi.) to over 100 per km.² and in restricted localities may greatly surpass the latter figure.

Northward of the 15th parallel there is an abrupt falling off of population densities on the edge of the Sahara Desert proper. Elsewhere in the West Africa-Sudan region, outside the main population concentrations described above, densities range mainly between 2.5 per km.² (6.5 per mi.²) and 10 per km.²; but the pattern is of such irregularity that it defies simple verbal description (See Figs. 1a, 1b). The broad zone of generally sparse population that separates the denser belt along the Guinea Coast from that in the Sudan is representative in that it consists of several small virtually uninhabited tracts and others of modest density. It is worth noting that the greater part of the valleys of the Senegal and Niger Rivers is relatively thickly settled. A rather more curious fact is the tendency of the British West African colonies notably Gambia and Sierre Leone but, to a lesser extent, the Gold Coast and Nigeria—to reach higher levels of density than neighboring French territory.[14]

The distribution of the population of the vast Central African region of sub-average densities is much simpler in pattern than is that of the other two regions. Only in the two most populous sub-regions—a band of territory running east-west through the Belgian Congo between the 4°S and 7°S parallels, and the west-central

[14] R. J. Harrison Church, "Major Contrasts Between French and British West Africa," unpublished paper read at XVIIth International Geographical Congress, Washington, 1952.

portion of Angola—are densities of more than 10 per km.² achieved over extensive areas, and in no administrative division is the figure of 50 per km.² (129.5 per mi.²) ever attained. Aside from the two aforementioned sub-regions, the only noticeable concentrations of population are three rather ill-defined areas in which densities range between 4 and 10 per km²—parts of northwestern Angola, central and eastern Southern Rhodesia, and the northern margins of the Belgian Congo. The Central African region contains sizeable tracts of essentially unoccupied territory (i.e., with less than 1 person per km²), the largest of which are found in southern Angola, Northern Rhodesia, the central Congo Basin, and within French Equatorial Africa and the French Cameroons. All the relatively empty regions, however, shade gradually into areas of somewhat higher density, so that if any trait can be said to distinguish the population pattern of Central Africa—as depicted at the small scale of Figures 1a, 1b—it is the absence of steep population gradients.

The situation is far different in East Africa where the element of contrast dominates the population map. An extreme irregularity of distributional pattern and abrupt alternation of unusually high densities with virtually unpopulated land is most pronounced in Kenya, Tanganyika, northeastern Belgian Congo, and Ruanda-Urundi and can also be observed in Nyasaland. The diversity of the physical geography of East Africa and, in particular, the great variability of altitude, relief and climate are undoubtedly related to this complexity of population pattern. Yet it is a complexity that cannot be reduced to any simple set of environmental formulae. The densest populations in East Africa—and in all of Tropical Africa for that matter—are those in the uplands of Ruanda-Urundi, a country with an average of 73.8 persons per km.² (191.1 per mi.²) and with some tracts exceeding 300 or even 400 per km². Comparable densities are achieved in the highlands of central Kenya and smaller highland clusters in northern Tanganyika. There are also densely settled high-altitude areas in southern Nyasaland and in central Madagascar, but, there are on the other hand, just as many mountain and high plateau tracts with densities varying from moderate to low, and some that appear completely deserted. The major concentration in the Shire Highlands of southern Nyasaland is especially noteworthy since it appears that, despite its excellent resources, the area began to attract population only after European planters began its development during the twentieth century.[15]

In the East Africa region, not only the highlands, but also the alluvial plains, exhibit similar extremes of population density. Higher-than-average densities characterize the lowlands fringing Lake Victoria, the shores of Lake Nyasa, the lower Zambezi Valley, and a good portion of the coastal plain along the shores of the Indian Ocean in East Africa proper as well as in eastern Madagascar. By contrast the margins of Lakes Rudolf, Edward, and Rukwa and the Rift Valley lakes of central Kenya and Tanganyika are thinly settled, and such is the case also along all but the northeastern side of Lake Tanganyika.

The less densely inhabited sections of Mozambique, Uganda, and Madagascar

[15] Gene E. Musolf, "The Population of Nyasaland," unpublished seminar paper.

are not conspicuously empty, having in most cases densities of from 2.5 to 10 persons per km², but in northern Kenya, west-central Tanganyika, and along the Kenya-Tanganyika border there are huge tracts of land as desolate as any in the whole of tropical Africa.

URBAN POPULATION

If the population of centers with 5,000 or more inhabitants may be classed as urban, then, according to the best information available at the present time, approximately 7.1% of the total population of tropical Africa, or some 8,595,000 individuals are urban (Table III). It should be noted that although a large proportion of the 920,000 non-African inhabitants of the region are urban, the make-up of the popu-

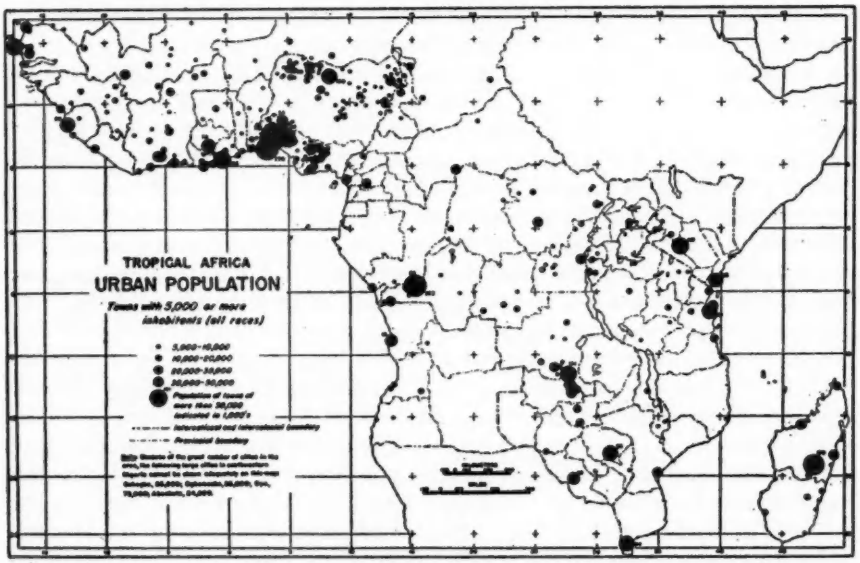

FIG. 2.

lation of tropical African cities is still overwhelmingly African. The relative numerical insignificance of city dwellers does not entitle them to detailed discussion here, but their distributional pattern is sufficiently distinct from that of rural population to call for some comment (Fig. 2).

In West Africa there is a positive correlation between numbers of rural people and of urban people so that the areas with large total and rural populations are also those with a large number of city dwellers. In other parts of tropical Africa this correlation is largely lacking, and most conspicuously in the densely settled but almost city-less regions of Uganda, Ruanda-Urundi, and Nyasaland. An explanation of Figure 2 must be sought not in any analysis of rural population patterns but in the aboriginal cultures of Africa and the economic activities of Euro-

peans. Among the relatively advanced peoples of Nigeria and other portions of West Africa an indigenous urban culture had developed in pre-European days, and only at a later date was a small scattering of cities founded by Europeans, mainly along the coast. All the cities of Central and East Africa, on the other hand, appear to be European in origin[16] and, aside from their administrative function, may be

TABLE II.

POPULATION BY COUNTRY AND RACE[1]

Country	Africans and Mixed Blood Groups (in 1,000's)	Europeans		Asians		Total
		No.	% of Total	No.	% of Total	
Angola	4,066	78,826	1.9	105	—	4,145,266
Belgian Congo	11,593	66,078	0.6	929	—	11,660,501
French Cameroons	3,064	12,086	0.4	183	—	3,077,300
French Equatorial Africa	4,412	23,407	0.5	*	—	4,434,800
French Togoland	1,029	1,011	0.1	77	—	1,030,000
French West Africa	17,299	63,100	0.4	*	—	17,361,700
Gambia	252	269	0.1	201	0.1	252,389
Gold Coast (1948)	4,112	5,167	0.1	1,603	—	4,118,450
Kenya (1948)	5,251	30,524	0.6	123,081	2.3	5,405,966
Liberia	1,648	*	—	*	—	1,648,000
Madagascar	4,415	28,190	0.6	19,330	0.4	4,463,801
Mozambique	5,669	48,813	0.8	14,268	0.3	5,732,767
Nigeria (1949)	25,995	4,952	—	490	—	26,000,000
Northern Rhodesia	1,685	37,220	2.2	2,530	0.1	1,725,000
Nyasaland	2,460	4,073	0.2	5,248	0.2	2,469,000
Portugese Guinea	509	2,254	0.4	14	—	510,777
Ruanda-Urundi	3,902	4,325	0.1	1,498	—	3,908,512
São Tomé and Principé	59	1,152	1.9	10	—	60,159
Sierra Leone	1,972	964	—	2,074	0.1	1,975,000
Southern Rhodesia	2,006	136,017	8.4	4,343	0.2	2,146,000
Spanish Guinea and Fernando Po	195	3,937	2.0	*	—	198,663
Tanganyika	7,697	17,885	0.2	72,764	0.9	7,787,000
Uganda	5,160	3,448	0.1	36,801	0.7	5,200,000
Zanzibar	203	296	0.1	60,452	22.5	264,162
Total	114,653	573,994	0.5	346,001	0.3	115,575,213

[1] For date of data (except where specified), see Table 1.

* No data; number probably quite small.

classified into two types: the transport-commercial centers (ocean, lake, and river ports; rail junctions) and mining centers. The major cluster of towns in Katanga and Northern Rhodesia and the few in Southern Rhodesia fall into the latter category, as do most of the cities of eastern Belgian Congo and Ruanda-Urundi. The

[16] Except for the Arab ports on the Indian Ocean.

remainder of the cities of Central and East Africa have their *raison d'etre* primarily in the movement of goods to and from European markets. Size and spacing of urban places show definite regional contrasts but no analysis of this topic of settlement geography is here attempted.

TABLE III.

URBAN POPULATION[1] BY COUNTRY

Country	Approximate Urban Population (in 1,000's)	Percentage of Total Population
Angola	249	6.1
Belgian Congo	925	8.0
French Cameroons	173	5.8
French Equatorial Africa	234	5.3
French Togoland	49	4.8
French West Africa	1,537	9.6
Gambia	20	7.7
Gold Coast	499	12.0
Kenya	253	4.8
Liberia	20	1.2
Madagascar	437	9.8
Mozambique	160	2.8
Nigeria[2]	2,936	9.4
Northern Rhodesia	332	18.4
Nyasaland	22	1.1
Portugese Guinea	7	1.4
Ruanda-Urundi	62	1.6
São Tomé and Principé	6	9.3
Sierra Leone	96	4.8
Southern Rhodesia	276	12.8
Spanish Guinea and Fernando Po	11	5.5
Tanganyika	208	2.7
Uganda	38	0.7
Zanzibar	45	17.0
Total	8,595	7.1

[1] Population of towns with 5,000 or more inhabitants.

[2] Data for Northern Region from Census of 1952; estimates for population of largest cities of Western and Eastern Regions drawn from 1950 figures in Great Britain, Colonial Office, Colonial Reports, *Nigeria, 1951* (London, 1953); other data from the Nigerian census of 1931.

THE NON-AFRICAN POPULATION

The distribution of the non-Africans, who form only about 0.75 per cent (573,994 Europeans; 346,001 Asians) of the total population of Tropical Africa is another matter of secondary interest if mere quantity is to be the chief criterion of importance. Moreover, since the subject of European and Asian settlement in Africa

has been discussed in many recent works,[17] only a few simple facts concerning their location need be noted here (Table II; Figs. 3 and 4). The relatively reliable statistics on Europeans and Asians[18] indicate a highly uneven distribution. This is especially true for the Asians who, except for a few thousand—mostly Levantine—individuals in West Africa, are concentrated almost wholly in Zanzibar, parts of Kenya and Tanganyika, and, to a lesser degree, in other countries on or near the Indian Ocean (Fig. 3). Since Arabs and Indians greatly outnumber other Asians, apparently only the factor of proximity to source areas need be summoned to account for this pattern.

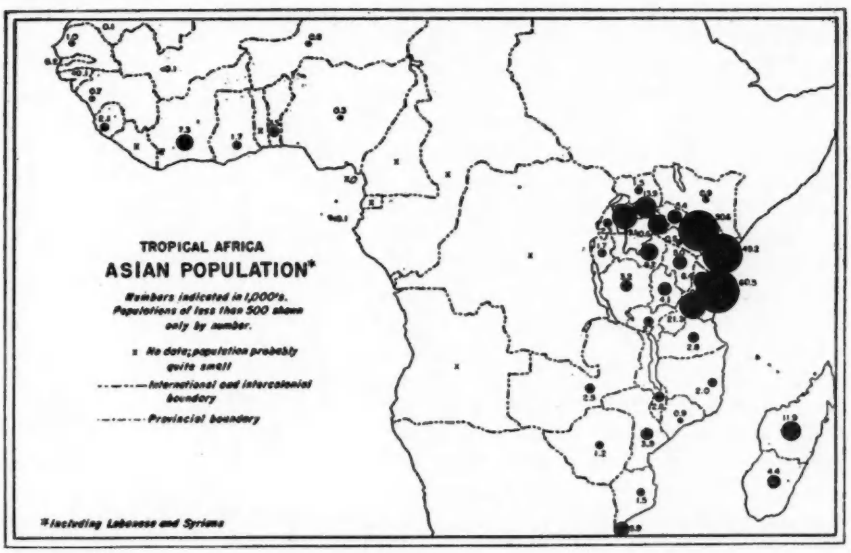
TROPICAL AFRICA
ASIAN POPULATION*
Numbers indicated in 1,000's.
Populations of less than 500 shown only by number.
x No data; population probably quite small
International and intercolonial boundary
Provincial boundary
*Including Lebanese and Syrians

FIG. 3.

The case of Europeans in tropical Africa is somewhat more complicated. Permanent colonists appear in appreciable numbers in the high plateaus of Kenya, Southern Rhodesia, and Madagascar, in portions of Angola and Mozambique, and, quite understandably, in the mining country of Katanga and the Rhodesias (Fig. 4). Their presence at higher altitudes is readily explainable in terms of both climatic comfort and the possibility of cultivating a number of commercial crops by planta-

[17] See, especially Kuczynski, *op. cit.*, (for British Africa), Carl Troll, "Weisser Siedlungsraum in Afrika," *Koloniale Rundschau*, XXVII (1936): 437–44 (for a discussion of Tanganyika, Kenya, and Italian Africa), and John H. Wellington, "Some Geographical Aspects of the Peopling of Africa," *South African Journal of Science*, XXXIV (1937): 29–60.

[18] Where these figures are available, it is usually in much greater areal detail than employed in Figures 3 and 4. It was felt that the relatively minor significance of non-African population did not warrant a finer break-down of the data. For references to more detailed maps, see Appendix I.

tion methods. The situation in Portugese Africa, and especially in Angola, is obscured by the problem of determining the identity and occupations of Europeans. After four centuries of miscegenation there is no sharp racial division between the Portugese and the Africans, and the census-takers prefer to list the population as either "civilized" or "uncivilized," i.e., Europeanized or non-Europeanized. Outside the regions listed above, the thin and widely scattered European population contains few permanent settlers and consists almost wholly of administrators, merchants, missionaries, and other transient personnel.

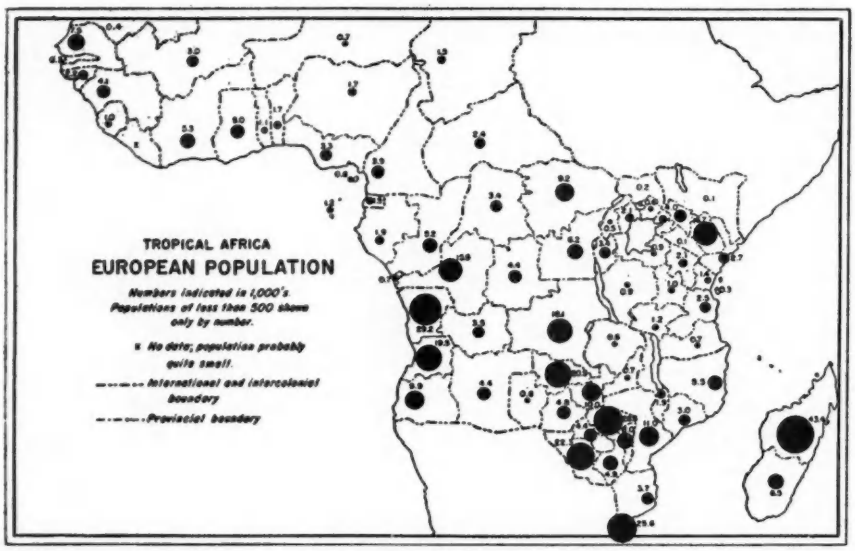
TROPICAL AFRICA
EUROPEAN POPULATION
Numbers indicated in 1,000's
Populations of less than 500 shown only by number.
x No data; population probably quite small.
International and intercolonial boundary
Provincial boundary

FIG. 4.

INTERPRETATION OF THE PATTERN OF POPULATION DISTRIBUTION

The small volume of work that has been produced to date on individual countries or areas render it impossible to undertake here any full-scale discussion of the genesis of the distributional patterns of tropical African population. What little is known makes it appear likely that an adequate explanation would be one of formidable complexity. In contrast to the more advanced regions of the world, where a combination of familiar environmental, economic, and historical facts often suffices to account for the location of populations that possess relatively homogenous characteristics, tropical Africa contains hundreds of more or less disparate cultures whose demographic behavior is governed, in part, by many non-economic cultural factors with which we are unfamiliar and concerning whose physical resources, history, and economy we are poorly informed. All that can be done here is to offer a brief survey of published hypotheses on the origin of certain African popu-

lation patterns, the available evidence for and against these hypotheses, and some indication of the more productive avenues for future research.[19]

The initial problem in tropical Africa's population geography—a general sparseness of settlement and the question of whether the region is underpopulated in terms of its indigenous cultures—must be left unanswered for lack of sufficient evidence. Since tropical Africa contains less than 4.5 per cent of the world's people living on approximately 11 per cent of the total land area of the earth, it would seem that the low average population densities must be attributed to relatively primitive levels of culture, unless, of course, it is assumed that the resource base is well below average. The apparent persistence of low densities for many centuries[20] would seem to indicate that the Negro populations have long since exhausted the possibilities for expanding the use of their resource base. Yet it is easy to find many cases of tribes of seemingly equal cultural capacity inhabiting neighboring regions of quite similar economic potential in quite unequal numbers.

The simplest hypothesis that has been brought forward to explain the distribution of population within tropical Africa invokes the various elements of the physical environment, both singly and in their totality, and undertakes to show a direct, relatively simple cause-and-effect relationship between physical and economic resources on the one hand and the size of a given population on the other. Perhaps the bluntest spokesman for the environmentalist school of thought is to be found in Charles Robequain who, in his brief account of the population geography of West and Central Africa, admits no other genetic factors.[21] Urvoy is less extreme in his explanation of the population map of the Sudan west of Lake Chad, for while he stresses rainfall, relief, and soil as the critical items, he is not unmindful of culture and history.[22] The most substantial attempt to equate population distribution with physical factors is that of Clement Gillman who studied Tanganyika's geography during his many years of residence in that territory.[23] He is emphatic in his view that the population pattern of the country is strongly controlled by its environment and, particularly, by its water supply. The relatively harsh but

[19] Some of the best materials on African demography and related topics have been presented in the following publications. They are especially useful to the student who wishes to acquaint himself with the wider aspects of population problems: Lord Hailey, *An African Survey; A Study of Problems Arising in Africa South of the Sahara.* London, 1938; W. M. MacMillan, *Africa Emergent, a Survey of Social, Political, and Economic Trends in British Africa.* London, 1938; E. B. Worthington, *Science in Africa, a Review of Scientific Research Relating to Tropical and Southern Africa.* London, 1938; and Kuczynski, *op. cit.*

[20] A. M. Carr-Saunders, *World Population: Past Growth and Present Trends.* London, 1936. pp. 300–06; and Marcel R. Reinhard, *Histoire de la Population Mondiale de 1700 à 1948.* Paris, 1950. pp. 470–81.

[21] Charles Robequain, "La Répartition des Hommes en Afrique Occidentale et Equatoriale," *Academie des Sciences Coloniales. Compte Rendu des Séances,* 1944: 611–15.

[22] Y. Urvoy, *Petit Atlas Ethno-Démographique du Soudan entre Sénégal et Tchad,* Memoires de l'Institut Français d'Afrique Noire, No. 5 (Paris, 1942), pp. 9–15.

[23] Clement Gillman, "South-West Tanganyika Territory," *Geographical Journal,* LXIX (1927): 97–131 and "A Population Map of Tanganyika Territory," *The Geographical Review,* XXVI (1936): 353–75.

variegated character of the East African environment must be especially conducive to such opinion since the same view—modified by some recognition of the operation of cultural factors—is offered by Dixey in his account of Nyasaland[24] and by Baker and White in their analysis of population distribution over the entirety of East Africa.[25] But it is worth noting that such notions are vigorously opposed in a review of Gillman's work by Ernst Nowack who maintains that variations within the African cultural pattern have at least as much effect on East African population distribution as do those in the physical millieu.[26]

Some understanding of the validity of the environmentalist point of view in tropical Africa can be gained by analyzing the correlations, or lack of them, between the more important single elements in the physical geography of the region and the distribution of population. Firstly, one of the principal environmentalist contentions is that altitude and landforms are significant factors and, more particularly, that altitudes of 1,000 to 2,000 meters with their cooler temperatures, higher rainfall, good pasture, relative freedom from disease, and characteristic superiority of soil attract population and that such is the case also for the productive soils of alluvial lowlands. This idea has already been shown to have some merit in East Africa, and it is quite possible that those exceptional highland areas and alluvial plains of East Africa which are thinly peopled can be shown to have an inadequate set of resources in spite of high elevations or fertile soils, e.g., those upland areas with insufficient rainfall or disease-ridden lowlands.

It is much more difficult to establish a good case for the efficacy of soils, landforms, and altitude in the remainder of tropical Africa. Although it is true that the valleys of the Niger, Senegal, Gambia, and Volta are densely settled, there are many more instances in West and, especially, Central Africa where lowlands are avoided as settlement sites and better drained land used instead. The Atlantic Coastal Plain of Africa is everywhere so narrow that, except possibly along the coast between Lagos and Accra, it is not possible to correlate it with population density. Among the subdued uplands of West and Central Africa, the two best instances of relatively densely settled higher lands are to be found in the high plateaus and hills of west-central Angola and the more mountainous portions of the Cameroons.[27] Except for the existence of a relatively dense population in the uplands of Plateau Province of central Nigeria, it is not possible to demonstrate any correlation between the location of uplands and that of dense populations in West Africa.

It is quite plain that the economic life of the sedentary peoples of tropical Africa

[24] F. Dixey, "The Distribution of Population in Nyasaland," *The Geographical Review,* XVIII (1928): 274–90.

[25] S. J. K. Baker, "The Distribution of Native Population over East Africa," *Africa.* X (1937): 37–54 and S. J. K. Baker and R. T. White, "The Distribution of Native Population over South-East Ceneral Africa," *Geographical Journal,* CVIII (1946): 198–210.

[26] Ernst Nowack, "Die Bevölkerungsverteilung in Deutsch-Ostafrika und ihre Ursachen," *Petermanns Geographische Mitteilungen,* LXXXVIII (1942): 367–69.

[27] A commentary on the distribution of population in the Cameroons appears in W. Oetting, "Die Volksdichte in Alt-Kamerun," *Koloniale Rundschau,* XXVI (1934): 116–20.

is predicated upon a certain minimum amount of rainfall and that where this minimum is not reached, as happens northward from a line near the 15th parallel in West Africa, in northern Kenya and scattered tracts throughout East Africa, and in the southern and south-western portions of Angola, density figures drop to extremely low levels. But within the relatively well-watered sections of tropical Africa there is little if any correspondence between maps of precipitation and of population. Indeed, two of the major population concentrations in Africa, the Sudanese and that coincident with the area between Lagos and Accra, not to mention the lesser one in western Senegal, are located in areas of such low rainfall that it is difficult to understand how so many people can subsist on local resources.

The matter of water as a factor affecting population density takes on more meaning, however, if the emphasis is shifted from rainfall to the availability of surface or ground water. It is not too implausible that "in so far as this (perennial water) supply is absent over wide areas and varies in amount and reliability in others, so is it faithfully reflected in the very uneven distribution of population"[28] even in regions which might appear from their rainfall records to have a sufficiency of moisture. Unfortunately, much less is known concerning the supply of surface and ground water in tropical Africa than about precipitation, so that judgment cannot be passed on this question until more detailed information is available.

Even less certain is the effect on tropical African population distribution of soil type and quality. Research on the agricultural economy of the Negro population has thus far failed to show clearly whether there is any significant amount of discrimination among soils on the basis of their potential productivity or ease of handling.[29] If any such selectivity is displayed by indigenous cultivators, it is still impossible to study it against the background of good soils maps since scientific surveys of soils in the area are in an exploratory phase.

A final environmental factor, endemic disease, is known to operate in many parts of tropical Africa as a major element in the choice of settlement sites. Yet disease cannot be regarded as one of the chief explanatory factors behind the population map for two reasons: a) its effect is local so that disease may be responsible for minor variations within the areal pattern of population regions but not for the existence of large population regions; b) the ecological relationships between man and some of the more important diseases of tropical Africa are so complex that the latter cannot be said to have a simple, one-way effect on population numbers.

A second school of thought on the problem regards the cultural and historical factor as the decisive one in the location of population in tropical Africa. Only rarely, as in the case of Richard-Molard,[30] do the supporters of this view reject the

[28] Baker and White, *op. cit.*, 207.

[29] The topic is explored at some length but inconclusively in Audrey I. Richards, *Land, Labour and Diet in Northern Rhodesia; an Economic Study of the Bemba Tribe.* London, 1939. See also Baker and White, *op. cit.*, 207.

[30] J. Richard-Molard, "Démographie et Structure des Sociétés Negro-Peul parmi les Hommes Libres et les 'Serfs' du Fouta-Dialon (Regions de Labé, Guinée, Française)," *La Revue de Géographie Humaine et d'Ethnologie,* I (1948–49) : 45–51.

influence of the physical environment. Rather they tend to regard the environment in terms of the capabilities of the various African cultures for exploiting its resources and to assign to these cultural differences among tribes at least as much significance in the explanation of uneven densities on the population map as they do to variations in the resource base. This viewpoint has been upheld most successfully by Pierre Gourou who has applied it to three areas within tropical Africa. In the case of the dense populations of southwestern Nigeria, Gourou attributes the great concentration to the type of indigenous economy and to the development of a rudimentary system for the commercial sale of agricultural products.[31] Although these concentrations pre-date the British, the phenomenon of temporary labor migration during recent years has permitted a continued increase in numbers. In his study of the Belgian Congo, Gourou notes abrupt differences in population numbers among adjoining tribes living in regions that show little variation in their physical characteristics and claims that the phenomenon is caused by differences in economy, social organization, and "l'aptitude à l'organisation de l'espace."[32] The most detailed treatment of the population geography of a tropical African region is Gourou's study of Ruanda-Urundi.[33] Although the extraordinary densities of this country are clearly made possible by its superior resources, and although Gourou's researches have shown an intimate, if highly complex, relationship between environment and number distribution, the author is firm in his opinion that the population of Ruanda-Urundi would not have been able to increase to its present size if it had not been for the superiority of its cultural and political organization which, in turn, has led to unusually great military and economic stability.

Although the basic facts are still too poorly known to permit much theorizing, it seems likely that a better case can be made for the explanation of the population geography of tropical Africa by a consideration of all the factors of its culture, history, and physical environment, both as they react directly on population and as they affect one another, rather than by any single-factor hypothesis. It is true that one factor may appear to outweigh the others—for example, the seeming supremacy of water-supply and landforms in parts of East Africa and variations in culture pattern in the Congo—but a single factor rarely operates to the exclusion of all others. Unfortunately, if little as is known of some of the major aspects of Africa's physical geography, even less is known about some important factors in its cultural geography and their effects on demography. There have been a few detailed studies of the inter-relationships of culture and demography for single communities,[34] but there is too little pertinent information on economics and social charac-

[31] Pierre Gourou, "Géographie du Peuplement en Nigeria Méridionale," *Société Belge d'Etudes Géographiques, Bulletin* XVII (1947) 58–64.

[32] Pierre Gourou, "La Géographie Humaine du Congo Belge," Université Libre de Bruxelles, Institut de Sociologie Solvay, *Revue de l'Institut de Sociologie,* XXIII (1950) : 5–23.

[33] Pierre Gourou, *La Densité de la Population au Ruanda-Urundi; Esquisse d'une Étude Géographique,* Institut Royal Colonial Belge, Section des Sciences Naturelles et Medicales, Memoires, Tome XXI, fasc. 6 (Bruxelles, 1953).

[34] Notably Brother Lamal, S. J., *Essai d'Étude Démographique d'une Population du Kwango,*

teristics among a large number of tribes to permit any broad inter-regional studies. Nevertheless, there have been some published observations involving cultural and historical facts that help explain the population map.

The striking contrast between the densely settled regions of northern and southern Nigeria and the relatively empty center of the country has attracted the attention of several writers. Dodge attempts to account for the major concentrations in the north by pointing out their strategic location astride the trans-Saharan trade routes which have been important phenomena in the economic geography of West Africa for the past several centuries.[35] A number of authors have explained the low densities of central Nigeria as being due to the slave-raids and related warfare that reduced the population there in the period before British occupation.[36] Presumably, the northern sections of the country were beyond the reach of the raiders, while the coastal areas were able to benefit from the slave-trade and from other forms of commercial intercourse with Europeans and may even have attracted migrants for that reason.[37] The sparseness of population in portions of East Africa has also been attributed to the long-term effects of slave-raids.[38]

In more recent times the impact of European culture has undoubtely had a decided, but highly complex, effect upon population change in tropical Africa and on the relative distribution of its population. Again, however, there has been no adequate study of this phenomenon. The most obvious way in which Europeans have altered the African population map has been by inaugurating the practise of labor migration which has displaced, temporarily or otherwise, a large proportion of the population of many localities. The literature on Africa's labor problems is voluminous,[39] but its treatment of the demographic effects of labor migration has been generally superficial. In a few cases, however, scholars have concerned themselves

---

les Basuku du Territoire de Feshi, Institut Royal Colonial Belge, Section des Sciences Morales et Politiques, Memoires, Tome XV, fasc. 4 (Bruxelles, 1949) and A. T. Culwick and G. M. Culwick, "A Study of Population in Ulanga, Tanganyika Territory," *Sociological Review,* XXX (1938) : 365–79 and XXXI (1939) : 25–43.

[35] Stanley D. Dodge, "The Distribution of Population in Northern Nigeria," *Papers of the Michigan Academy of Science, Arts and Letters,* XIV (1936) : 297–303.

[36] E.g., Karl Rehm, "Das Problem der Bevölkerungsschätzung Afrikas," *Geographischer Anzeiger,* XXIX (1928) : 366–67 and C. R. Niven, "Some Nigerian Population Problems," *Geographical Journal,* LXXXV (1935) : 54–58.

[37] This hypothesis has also been suggested for the densely settled coastal area of the Gold Coast by G. V. Fuguitt (unpublished seminar paper).

[38] Fernand Maurette, *Afrique Equatoriale et Australe,* Géographie Universelle, Vol. 12 (Paris, 1938), 42 and Joachim H. Schultze, "Zur Ökologie menschlicher Lebensführung in den Afrikanischen Tropen," *Die Erde,* I (1949–50) : 136. This argument is supported by recent striking increases in population in some sections of east and south-central Africa that were once especially subject to the depredations of slavers.

[39] Some of the more noteworthy studies are G. St. J. Orde Browne, *The African Labourer.* London, 1933; Oskar Karstedt and Peter von Werder, *"Die Afrikanische Arbeiterfrage," Afrika, Handbuch der praktischen Kolonialwissenschaften,* Vol. XVIII, Pt. 1. Berlin, 1941; and John A. Noon," *Labor Problems of Africa, African Handbooks,* No. 6. Philadelphia, 1944.

with the effects of labor emigration on the population of individual areas.[40] Harrison Church, in discussing the contrasts in population density between French and British West Africa, suggests that migration to British territory with its higher wages and lower prices for consumers goods, may be largely responsible for the differences.[41] It has already been indicated that the recent rise of plantation agriculture in the area, with its need for a large number of African laborers from neighboring regions, is largely responsible for the dense aggregation of population in the Shire Highlands of southern Nyasaland.

TABLE IV.

SEX RATIO AMONG (DE FACTO) AFRICAN POPULATION, BY COUNTRY*

Country	Date	Sex Ratio, Total	Sex Ratio, Adult
Fernando Po	1950	227.4	—
São Tomé and Principé	1950	153.2	—
Gambia	1931	110.9	115.0
Zanzibar	1948	108.5	103.3
Gold Coast	1948	102.2	100.2
French Togoland	1951	101.0	90.6
Uganda	1948	99.9	95.5
Belgian Congo	1951	98.3	92.6
Tchad (F.E.A.)	1950	98.0	91.8
Portugese Guinea	1950	97.6	88.5
Tanganyika	1948	97.5	83.1
Oubangi-Chari (F.E.A.)	1951	97.3	90.4
Southern Rhodesia	1948	95.8	87.9
Angola	1950	95.6	—
Nigeria	1952–53	95.0	—
Madagascar	1952	94.9	89.9
Sierra Leone	1948	94.8	87.2
Moyen-Congo (F.E.A.)	1950	93.5	84.4
Mozambique	1950	92.1	—
Ruanda-Urundi	1950	91.9	85.8
Northern Rhodesia	1950	91.0	80.9
Spanish Guinea	1950	90.5	—
French Cameroons	1945	90.3	81.5
Gabon (F.E.A.)	1950	90.2	80.1
Nyasaland	1945	86.1	68.4

* No data available for French West Africa.

Data on migration, whether international or internal, are quite inadequate for

[40] For example, Margaret Read, "Migrant Labour in Africa and its Effects on Tribal Life," *International Labour Review*, XLV (1942): 605–31, a discussion of Nyasaland, and V. Zanetti and W. Wouters, "Evolution Démographique et Facteur 'Recrutement' dans Deux Groupements Mabuda au Nepoko (Congo Belge), *"Institut Royal Colonial Belge, Bulletin des Séances*, XVIII (1947): 580–601.

[41] Harrison Church, *op. cit.*

most African countries, although a rough idea of the volume and direction of international movements can be gained by studying the data on sex ratio (Table IV), a much larger number of males than females being involved in labor migrations. Sex ratio is, however, an imperfect index to migration since other factors, notably differential mortality, also can affect it considerably. Hence, the only safe conclusions that can be drawn from Table IV is that the islands in the Gulf of Guinea, Gambia, Zanzibar, the Gold Coast, Uganda, and the Belgian Congo have experienced a net gain of population through immigration and that Nyasaland, Northern Rhodesia, the French Cameroons, and Gabon have lost heavily.[42] There is a fair amount of direct information concerning population movements among certain countries, especially in British East Africa,[43] but there is uncertainty concerning the effects of other international migrations, and, most particularly, internal migration, on current population distribution in tropical Africa.

Another factor introduced by Europeans has been a modern highway and railroad system which, in some areas, has rearranged the pre-European population patterns by attracting considerable numbers of Africans to the vicinity of the new routes. This is a factor which appears to have been especially important in the Gold Coast,[44] but has also been observed in Southern Rhodesia.[45]

CONCLUSION

In conclusion, it may be well to list and re-emphasize some of the major needs of the population geographer if the study of the population of tropical Africa is to be carried much beyond the level attained in this paper and the writings upon which it is based.

As it applies to the more adequate and refined mapping of the spatial arrangement of numbers and characteristics of population, the most urgent need is for more reliable, complete and detailed enumerations of population and at frequent intervals. Some improvement in this aspect of the situation is already obvious but it is a beginning only. Better base maps of the region are urgently required, but even more pressing is the need for publication of a series of general maps covering the various countries of tropical Africa at a scale of at least 1:250,000, together with related maps and information concerning soils, water and other elements of the resource base of value to the indigenous population. First hand observation in the field is not commonly thought of as applying to population geography, yet field work can

[42] Although in each of these countries certain districts have gained markedly at the expense of the other sections of the country and by migration from neighboring lands.

[43] Kuczynski, *op. cit.*, offers an exhaustive presentation of all statistical material on international African migration involving British territory. The same material is treated more briefly but with the addition of a map showing something of the routes and volume of migration in K. Kayser, "Die Eingeborenen-Arbeit als Problem der Bevölkerungs- und Wirtschaftsstruktur Deutsch-Ostafrikas," *Geographische Zeitschrift*, XLV (1939): 121–38.

[44] Steel, *op. cit.* and T. E. Hilton, "The Distribution and Density of Population in the Gold Coast Colony and Southern Togoland," International Geographical Union, XVIIth International Geographical Congress, *Abstract of Papers*, Publication No. 6 (Washington, 1952), p. 39.

[45] Baker and White, *op. cit.*, 208.

do much to supplement the inadequate statistics, and more especially to amplify the meager information now available concerning characteristic settlement groupings of population.

The information most urgently required, in addition to that on physical resources, for a proper interpretation of population distribution is, however, cultural in nature, for nothing would be more valuable than a series of studies describing the economics of various African tribes and those aspects of their ethnology affecting demography. Finally, the many phases of African-European contact must be more fully explored, and the differential effects of Europeanization on the various parts of the region evaluated. In short, an adequate understanding of the population geography of an area requires the most thorough knowledge possible of its entire human geography, and further success in explaining the distribution of tropical Africa's population awaits progress along a broad scientific front.

Accepted November 1953.

Appendix I

POPULATION MAPS OF AFRICA

A list of the most recent and detailed published items

Africa:

John Bartholomew. *The Advanced Atlas of Modern Geography.* New York, McGraw-Hill, 1950, p. 79. 1:35,000,000; six density patterns.

Achille Dardano and Riccardo Riccardi. *Atlante d'Africa.* Milan, Ulrico Hoepli, 1936, p. 21. "Africa: Distribuzione della Populazione (1934);" 1:70,000,000; one dot to 100,000 persons; cities over 100,000 represented.

Antonio Augusto Mendes Corrêa, "Computos da Populaçao Global da Africa" Portugal, Instituto Nacional de Estatistica, Centro de Estudos Demograficos, *Revista,* No. 5, p. 22. Scale approx. 1:60,000,000; 1 dot to 50,000 persons; cities over 100,000 shown.

J. F. Unstead and E. G. R. Taylor, eds. *Africa; Density of Population.* London, The London Geographical Institute and George Philip & Son, n. d. Wall map; 1:9,000,000; eight density tints; cities over 50,000 represented.

Africa, European and Asian Population:

Hilde Binder, "Die Verteilung der Europäer in Afrika," *Koloniale Rundschau,* 26 (1934): 176–179. Small-scale map showing European population in 1931 by means of dots and circles; sources cited.

Fritz Jaeger. *Afrika* (in Allgemeine Länderkunde). Leipzig, Bibliographisches Institut, 1928, map facing p. 64. Bevölkerungsdichte von Afrika nach P. Pech;" Scale 1:53,000,000; African, Indians, and Europeans distinguished by means of complex dot symbols.

West Africa:

J. Richard-Molard and Paul Pelissier. *Cartes Ethno-Démographiques de l'Afrique Occidentale,* Feuilles No. 1. Dakar, Institut Francais d'Afrique Noire, 1952. Scale 1:1,000,000; seven density patterns; cities over 30,000 represented. The entire series will cover all of West Africa; but the single sheet published to date takes in only the territory west of the 12° W meridian.

Charles Robequain. *"Densité de la Population en Afrique Occidentale et Centrale.* Paris, Office de la Recherche Scientifique Coloniale, 1945(?). Scale 1:5,000,000; six density patterns; data largely from period 1935–1938.

Y. Urvoy. *Petit Atlas Ethno-Démographique du Soudan entre Sénégal et Tchad,* Memoires de l'Institut Francais d'Afrique Noire, No. 5. Paris, Librairie Larose, 1942, Plate 1, "Densités de Peuplement." Scale approximately 1:5,500,000; six density patterns; data by cantons.

Central Africa:

Karl Rehm. "Das Problem der Bevölkerungsschätzung Afrikas," *Geographischer Anzeiger,* 29 (1928): 361–71; appended map, "Volksdichte im Mittleren Afrika, auf Grund des Quellenmaterials bis zum Jahre 1910 (bzw. 1927). . . ." Scale 1:20,000,000; ten density patterns.

Charles Robequain, *op. cit.*

East Africa:

S. J. K. Baker, "The Distribution of Native Population over East Africa, "*Africa,* 10 (1937): 43. Small-scale dot map covering Uganda, Kenya, Tanganyika, and Ruanda-Urundi.

——— and R. T. White, "The Distribution of Native Population over South-East Central Africa," *Geographical Journal,* 108 (1946): 201. Small-scale dot map covering Katanga, Nyasaland, Rhodesias, southern Tanganyika, and northern Mozambique.

Carl Troll, "Weisser Siedlungsraum in Afrika," *Koloniale Rundschau, 27* (1936): 437–44. Covers Uganda, Kenya, Tanganyika, Ruanda-Urundi, and Zanzibar; scale approx. 1:7,000,000; one dot equals 1,000 persons and in congested areas 5,000.

Angola:

Portugal, Ministério des Colónias, Junta das Missões Geográficas e de Investigações Coloniais. *Atlas de Portugal Ultramarino e das Grandes Viagens Portugesas de Descobrimento e Expansão.* Lisbon, 1948, Plate 65. Scale 1:6,000,000; six density patterns.

Belgian Congo:

Pierre Gourou, "Carte de la Densité de la Population," *Atlas Général du Congo Belge.* Bruxelles, Institut Royal Colonial Belge, 1951. Scale 1:5,000,000; twenty density patterns; data by native circonscriptions; towns over 1,000 represented.

Institut Géographique du Congo Belge. *Congo Belge. Répartition de la Population Indigène,* six sheets. Léopoldville, 1949. Scale 1:1,000,000; 1 dot to 500 persons.

French Cameroons:

French Cameroons, Haut Commissaire de la République Française au Cameroun. *Atlas du Cameroun.* Paris, Editions S.E.L.P.A., 1948, unnumbered plate in Part 1, "Densité de la Population par Region d'apres Documents de la Direction des Travaux Publics du Cameroun." Scale 1:3,000,000; six density patterns.

Guillaume Grandidier. *Atlas des Colonies Françaises, Protectorats et Territoires sous Mandat de la France.* Paris, Société d'Editions Géographiques, Maritimes et Coloniales, 1934, Plate XXIII, "Essai de Carte de la Densité de la Population." Covers French Equatorial Africa and Cameroons; scale 1:10,000,000; eight density patterns.

W. Oetting, "Die Volksdichte in Alt-Kamerun," *Koloniale Rundschau,* 26 (1934): 116–20. Scale approx. 1:5,000,000; six density patterns; 1931 data.

French Equatorial Africa:

French Equatorial Africa, Haut Commissariat de l'Afrique Equatoriale Française. Annuaire Statistique de l'Afrique Equatoriale Française. Volume 1, 1936–1950. n. p., 1950, p. 43. "Densité de Population du Gabon et du Moyen Congo au Km². " Scale approx. 1:7,000,000; eight density categories; 1950 data.

French Equatorial Africa, Secretariat Général du Gouvernement, Direction de la Documentation. *Afrique Equatoriale Française. Carte No. 42,* Inset: "Densité de la Population." Scale 1:15,000,000; five density patterns.

Grandidier, *op. cit.*

Gambia:

H. Reginald Jarrett, "Population and Settlement in the Gambia," *Geographical Review,* 38 (1948): 634–35. Scale approx. 1:2,250,000; village location shown.

Gold Coast:

Gold Coast Survey Department. *Atlas of the Gold Coast.* Accra, 1949, pp. 4–5. Scale 1:1,500,000; six density patterns.

R. W. Steel, "The Population of Ashanti: a Geographical Analysis," *Geographical Journal,* 112 (1948): 64–77. P. 68, "Ashanti, Density of Population, 1921." Scale approx. 1:4,000,000; five density patterns. P. 69, "Ashanti, Density of Population, 1931." Scale approx. 1:4,000,000; four density patterns. P. 71, "Ashanti, Distribution of Towns, 1931." Scale approx. 1:4,00,000; all towns over 1,000 represented. Facing p. 76, "Ashanti Distribution of Population." Scale 1:1,000,000; dot symbols representing buildings and villages shown on 1:250,000 maps of Gold Coast Survey.

Kenya:

Elspeth Huxley and Margery Perham. *Race and Politics in Kenya; a correspondence between Elspeth Huxley and Margery Perham.* London, Faber and Faber, 1944. End paper, "Kenya—Native Population." Scale approx. 1:10,000,000; one dot equals 5,000 persons; 1940 data.

Liberia:

Earl Parker Hanson, "An Economic Survey of the Western Province of Liberia," *Geographical Review,* 37 (1947): 55, "Western Province; Population Distribution." Scale 1:3,500,000; five density patterns.

Madagascar:

Pierre Gourou, "La Population de Madagascar," *Annales de Géographie,* 53 (1944) : 300. Scale 1 : 13,300,000; seven density patterns; 1936 data.

Mauritania:

France, Ministère de la France d'Outre-Mer, Office de la Recherche Scientifique Outre-Mer. *Carte Démographique de Mauritanie.* Paris, 1950. Scale 1 : 1,300,000; seven density patterns.

Mozambique:

Portugal, Ministério das Colónias, Junta das Missões Geográficas e de Investigações Coloniais. *Atlas de Portugal Ultramarino e das Grandes Viagens Portugesas de Descobrimento e Expansão.* Lisbon, 1948, Plate 79. Scale 1 : 6,000,000; six density patterns.

Nigeria:

Stanley D. Dodge, "The Distribution of Population in Northern Nigeria," *Papers of the Michigan Academy of Science, Arts, and Letters,* 14 (1936) : 297–303. Dot map; one dot to 1,000 persons.

Nigeria, Survey Department. *Population (1931 Census). Map of Nigeria, 1949.* Lagos, 1949. Scale 1 : 3,000,000; six density patterns.

Margery Perham. *Native Administration in Nigeria.* London, Oxford University Press, 1937, appended map, "Population Map of Kano Province." Scale approx. 1 : 1,750,000; six density patterns; 1931 data?

Northern Rhodesia:

J. Merle Davis, ed. *Modern Industry and the African.* London, Macmillan, 1933, appended map. Scale 1 : 6,400,000; seven density patterns.

Nyasaland:

F. Dixey, "The Distribution of Population in Nyasaland," *Geographical Review,* 18 (1928) : 276. Scale 1 : 4,625,000; six density patterns.

Portuguese Guinea:

Portugal, Ministério das Colónias, Junta das Missões Geográficas e de Investigações Coloniais. *Atlas de Portugal Ultramarino e das Grandes Viagens Portugesas de Descobrimento e Expansão,* Plate 38. Scale 1 : 2,000,000; five density patterns.

Ruanda-Urundi:

Pierre Gourou. *La Densité de la Population au Ruanda-Urundi; Esquisse d'une Etude Geographique,* Institut Royal Colonial Belge, Section des Sciences Naturelles et Medicales, Memoires, Tome XXI, fasc. 6. Bruxelles, 1953, appended map, "Densité de la Population au Ruanda-Urundi." Scale 1 : 750,000; twenty density patterns.

Institut Géographique du Congo Belge. *Ruanda-Urundi. Répartition de la Population Indigène.* Léopoldville, 1949. Scale 1 : 500,000; one dot equals 500 persons.

São Tomé and Principé:

Portugal, Ministério das Colónias, *op. cit.,* Plates 48 and 49. Scale 1 : 250,000; five density patterns.

Senegal:

France, Ministère de la France d'Outre-Mer, Office de la Recherche Scientifique Outre-Mer. *Carte Démographique du Sénégal.* Scale 1 : 1,000,000; seven density patterns.

Sierra Leone:

Sierra Leone, Surveys and Land Department. *Sierra Leone; Population Density.* Freetown, 1950, Scale 1 : 1,000,000; seven density patterns.

Southern Rhodesia:

Great Britain, Colonial Office. *Rhodesia-Nyasaland Royal Commission. Report,* Cmd. 5949. London, H.M.S.O., 1939. Appended map covers Rhodesias and Nyasaland. Scale approx. 1 : 2,750,000; five density patterns.

Tanganyika:

Clement Gillman, "South-West Tanganyika Territory," *Geographical Journal,* 69 (1927); 119. Scale approx. 1:5,600,000; six density patterns.

———, "A Population Map of Tanganyika Territory," *Geographical Review,* 26 (1936): Plate II. Scale 1:3,000,000; one dot equals 200 persons.

Tanganyika, Department of Lands and Mines, Survey Division *Atlas of the Tanganyika Territory.* Dar Es Salaam, Government Press, 1948. Plate 12, "Native Population Map." Scale 1:4,000,000; one dot equals 500 persons; 1945 data. Plate 13, "European Population Map." Scale 1:4,000,000; one dot equals 5 persons. Plate 14, " Asiatic Population Map." Scale 1:4,000,000; one dot equals 10 persons.

Uganda:

H. B. Thomas and Robert Scott, *Uganda.* London, Oxford University Press, 1935, 272, "Uganda Protectorate; Distribution of Native Population." Scale approx. 1:3,500,000; one dot equals 1,000 persons.

Appendix II

PRINCIPAL STATISTICAL SOURCES

Bibliography:

United States Library of Congress, Reference Department and United States Department of Commerce, Bureau of the Census. *Population Censuses and Other Official Demographic Statistics of British Africa; an Annotated Bibliography.* Washington, 1950.

———. *Population Censuses and Other Official Demographic Statistics of Africa (not Including British Africa); an Annotated Bibliography.* Washington, 1950.

General:

Leon E. Seltzer, ed. *The Columbia-Lippincott Gazetteer of the World.* New York, 1952. Valuable for otherwise inaccessible figures on population of cities.

Belgian Congo:

Belgium, Ministère des Colonies. *Rapport sur l'Administration de la Colonie du Congo Belge pendant l'Année 1951 presenté aux Chambres Legislatives.* Bruxelles, 1953. Estimates based on partial registration of African population. Data on total number, sex, and adults and children, by province, district, and territoire. Sample vital statistics. Detailed information on European population.

Pierre Gourou. "Notice de la Carte de la Densité de la Population au Congo Belge et au Ruanda-Urundi," *Atlas Général du Congo,* Institut Royal Colonial Belge. Bruxelles, 1951. Contains otherwise inaccessible data on urban populations.

French Cameroons:

France, Ministère de la France d'Outre-Mer, Service Colonial des Statistiques. *Annuaire Statistique du Cameroun, Volume I, 1938–1945.* Paris, 1947. No indication of method of enumeration, probably estimates by administrators. Data on total number, sex, adults and children, and population density by "region" and "subdivision."

French Equatorial Africa:

French Equatorial Africa, Haut Commissariat de l'Afrique Equatoriale Française. *Annuaire Statistique de l'Afrique Equatoriale Française, Volume I, 1936–1950.* n. p., 1951(?). Estimates, by region and district, of total number, sex, and adults and children.

French Togoland:

France, Ministère de la France d'Outre-Mer, Service des Statistiques. *Annuaire Statistique de l'Union Française Outre-Mer, 1939–1946. Chapitre B- Territoire et Population.* Paris, 1948. Probably simple estimate. Total number, Europeans, Africans, and population density given by colony, cercle, and subdivisions.

French West Africa:

France, Ministère de la France d'Outre-Mer, Service des Statistiques. *Annuaire Statistique de l'Union Française Outre-Mer, 1939 and 1946. Chapitre B- Territoire et Popu-*

lation. Paris, 1948. Probably simple estimate. Total number of Africans and Europeans by colony and cercle. Population density by colony and cercle. Population of principle cities.

Gambia:

Great Britain, Colonial Office, Colonial Reports. The *Gambia, 1950 and 1951.* London, 1953. Estimate of total population at present time based on previous censuses, city populations, and European population.

Gold Coast and British Togoland:

Gold Coast, Census Office. *Census of Population, 1948; Reports and Tables.* Accra, 1950. Fairly elaborate census employing local administrative officers. Data, by village, on total number, sex, age-group, and housing.

Kenya:

East Africa High Commission, The East African Statistical Department. *Quarterly Economic and Statistical Bulletin,* No. 18. Nairobi, December, 1952. Enumeration by unspecified method, of number, race, tribe, sex, and population density for province and district. Data on sizes of cities.

———. *Geographical and Tribal Studies.* London, 1950.

Liberia:

Liberia, Department of State, Bureau of Information, *Liberia.* Monrovia, 1952(?). Rough estimate of total population.

L. T. Badenhorst, "Population Distribution and Growth in Africa," *Population Studies,* 5 (July, 1951), 34. Rough estimate of total population, Mid-1949.

Madagascar:

Madagascar, Service de Statistique Générale. *Bulletin de Statistique Générale,* Vol. 2. Tananarive, 1951. Data, by province and district, on total number and race. Data on city size.

Nigeria and British Cameroons:

Nigeria. *Census of Nigeria, 1931,* 6 vols. London, 1932–33. Standard census techniques attempted for enumeration but with only moderate success. Data on numbers given for all divisions down to individual villages. Data on age-group, nativity, occupation, and religion.

R. R. Kuczynski. *Demographic Survey of the British Colonial Empire. Volume I, West Africa,* London, 1948. (For 1942 estimates of population by province and district.)

Great Britain, Colonial Office, Colonial Reports. *Nigeria, 1951.* London, 1953. For 1950 estimates of population for entire country.

Northern Rhodesia:

Northern Rhodesia, Central African Statistical Office. "The 1950 Sample Survey of the African Population of Northern Rhodesia," *Economic and Statistical Bulletin of Northern Rhodesia,* Vol. 3, No. 10 (January, 1951) : 5–13. Estimates based on extrapolations from sample survey. Total number, sex, adults and children by province.

Great Britain, Colonial Office, Colonial Reports. *Northern Rhodesia, 1951.* London, 1952. 1946 and 1951 data on Europeans.

Nyasaland:

Nyasaland Protectorate. *Report on the Census of 1945.* Zomba, 1946. Data, by province and district, on total number, sex, race, and age-group.

Portugese Africa:

Portugal, Institut Nacional de Estatistica. *Anuario Estatistico do Ultramar, 1950–1951.* Lisbon, 1952. Data on total number, sex, age-group, and race, by province, intendencia, and conselho.

Ruanda-Urundi:

Belgium, Ministere des Colonies. *Rapport Soumis par le Gouvernement Belge a l'Assemblée des Nations Unies au Sujet de l'Administration du Ruanda-Urundi pendant l'Année*

1951. Bruxelles, 1952. Estimates based on partial registration of African population. Total number, sex, adults and children by colony, sultanate, and territoire. Detailed data on European population.

———. *Plan Decennal pour le Developpement Economique et Social du Ruanda-Urundi.* Bruxelles, 1951. Information as of 1949 of type indicated in preceding item. Also historical resumé of earlier data.

Pierre Gourou. "Notice de la Carte de la Densité de la Population au Congo Belge et au Ruanda-Urundi," *Atlas Générale du Congo,* Institut Royal Colonial Belge. Bruxelles, 1951. Otherwise inaccessible data on urban populations.

———. *La Densité de la Population au Ruanda-Urundi; Esquisse d'une Etude Géographique.* Institut Royal Colonial Belge, Section des Sciences Naturelles et Medicales, Memoirs, Tome XXI, fasc. 6. Bruxelles, 1953. Tables on area and population density of sous-chefferies (the smallest administrative division). Base map show territoires, chefferies, and sous-chefferies.

Sierra Leone:

Sierra Leone. *Census of the Colony and Protectorate of Sierra Leone, 1949.* Freetown, 1950. Not available to authors at time of writing.

Great Britain, Colonial Office, Colonial Reports. *Sierra Leone, 1951.* London, 1952.

Southern Rhodesia:

Central African Statistical Office. *Report on the Census of Population of Southern Rhodesia Held on 7th May, 1946.* Salisbury, n. d. Detailed data on European, Asian, and colored population, but none of value on native Africans.

J. R. H. Shaul and C. A. L. Myburgh, "Provisonal Results of the Sample Survey of the African Population of Southern Rhodesia, 1948," *Population Studies,* Vol. 3, No. 3 (December, 1949) : 274–85. Estimates by province and district, of total number, sex, and adults and children, based on sample survey.

Spanish Guinea and Fernando Po:

Spain, Instituto Nacional de Estadistica. *Anuario Estadistico de España.* Madrid, 1950. 1942 census results. Total number and sex, by colony.

Tanganyika:

East Africa High Commission, The East African Statistical Department, *Quarterly Economic and Statistical Bulletin,* No. 18. Nairobi, December, 1952. Same information as for Kenya.

Uganda:

East Africa High Commission, The East African Statistical Department. *Quarterly Economic and Statistical Bulletin,* No. 18. Nairobi, December, 1952. Same information as for Kenya.

Zanzibar and Pemba:

Great Britain, Colonial Office, Colonial Reports. *Zanzibar, 1949 and 1950.* London, 1952. Estimates based on previous censuses. Total number, Europeans, and Asians, by colony.

THE POPULATION GEOGRAPHY OF BELGIAN AFRICA*

GLENN T. TREWARTHA AND WILBUR ZELINSKY
University of Wisconsin

IN a previous paper[1] by the same authors an attempt was made to analyze through maps and text the general patterns of population-numbers distribution in the extensive region of tropical Africa. In such an area, composed as it is of numerous colonial units, each with its own system for collecting statistics, the limitations on what can be done for the area as a whole are set by the lowest-quality data from any individual colony.

In the present paper the focus is sharpened, for it deals only with one contiguous political unit of tropical Africa, viz., the Belgian dependencies of the Congo and Ruanda-Urunda. While the quantity and quality of the population data for Belgian Africa are superior to those of most colonies in the same general region, certain it is they are seriously deficient compared to those that are available for many of the more advanced nations of the world. This study, therefore, is viewed by the authors as a test case to determine what can be done in a brief treatment of the population geography of an area[2] for which the data sources are meager and unreliable, and for which field experience is lacking.

I. THE SIZE AND GROWTH OF POPULATION

Present size of population

The most recent official estimate of the African population of the Belgian Congo (December 31, 1951) indicates a total of around 11,600,000, while that for Ruanda-Urundi (December 31, 1950) is slightly over 3,900,000, so that the probable combined total for the two territories in 1951 must, officially, have been in the neighborhood of 15,500,000.[3] Unfortunately, the validity of this most basic of all

* The term Belgian Africa as here used includes the Belgian Congo and Ruanda-Urundi. This work was supported in part by a grant from the Special Research Fund of the University of Wisconsin.

[1] Glenn T. Trewartha and Wilbur Zelinsky, "Population Patterns in Tropical Africa," *Annals of the Association of American Geographers,* XLIV (June, 1954) : 135–162.

[2] For a treatment of the nature and content of population geography see, Glenn T. Trewartha, "A Case For Population Geography," *Annals of the Association of American Geographers,* XLIII (June 1953) : 71–97.

[3] These figures are drawn from:

Belgium, Ministère des Colonies, *Rapport sur l'Administration de la Colonie du Congo Belge pendant l'Année 1951 Presenté aux Chambres Legislatives.* Bruxelles, 1953.

Ibid., Rapport Soumis par le Gouvernement Belge à l'Assemblée des Nations Unies au Sujet de l'Administration du Ruanda-Urundi pendant l'Année 1950. Bruxelles, 1951.

All statistics quoted in this work are derived from these series and from the following two volumes, unless specific reference is made to other sources:

Belgium, Ministère des Colonies, *Plan Decennal pour le Developpement Economique et Social du Congo Belge* (Bruxelles, 1949).

population statistics is highly dubious. In theory, the technique used for enumerating African population ought to provide a nearly perfect continuing census; but in practice, it has fallen far short of this ideal.[4] The identity and vital events in the life of each individual supposedly are recorded on cards which are kept on file in governmental offices. Although an ever increasing proportion of the population has thus been counted, it was estimated as recently as 1947 that some 30 per cent of all Africans in the Congo had not yet been provided with cards.[5] This uncounted portion is apparently estimated locally by government officials by means of formulae which are not disclosed in the literature. Even among those whose names are inscribed on cards there is great laxity in reporting births, deaths and migrations. In all fairness to the Belgian administration, it must be said that their system for estimating population—while not, strictly speaking, a census—furnishes data probably as accurate as those for any other portion of tropical Africa and more precise than the information gathered in some colonies going through the motions of a formal census.

Fortunately, there has been at least one thoroughgoing, independent check on the completeness of the government's population statistics—the medical surveys of the Bas-Congo region conducted from the early 1930's onward by FOREAMI (Fonds Reine Elisabeth pour l'Assistance Médicale aux Indigènes du Congo Belge).[6] Repeated visits to all villages and families in the FOREAMI area have been made in such a way that only a minute fraction of the population could possibly escape being counted. The results indicate that the official enumerations have failed to list as many as 20 per cent of the inhabitants of some areas and are always guilty of underenumeration.[7] Since the same phenomenon has been reported by medical surveys of smaller scope in other portions of the Congo,[8] it is highly probable that the official population figures for Belgian Africa are universally low. Thus it is not impossible that 10 per cent or even 20 per cent of the total population may be unaccounted for and that the true total for Belgian Africa may be between 17,000,000 and 19,000,000 instead of 15,500,000.

Changes in population size

The history of population numbers in Negro Africa is one of the most perplexing problems in its historical geography. In the case of Belgian Africa, only the

Ibid., Plan Decennal pour le Developpement Economique et Social du Ruanda-Urundi (Bruxelles, 1951).

[4] The fullest account of the decrees and regulations pertaining to census-taking in the Belgian Congo is given in J. Magotte, *Organisation Politique et Administrative des Populations Indigènes. Les Circonscriptions Indigènes* (Léopoldville (?), 1952).

[5] Since 1947 no data have been published on the number of individuals enumerated on cards.

[6] The results of these investigations are published in annual reports, the most recent of which is FOREAMI, *Rapport sur l'Activité durant L'Année 1950.* Bruxelles, 1951.

[7] P. Ryckmans, "Notes sur la Démographie Congolaise," Institut Royal Colonial Belge, *Bulletin des Séances,* II (1931): 255.

[8] J. Schwetz, "Contribution à l'Etude de le Démographie Congolaise," *Congo: Revue Générale de la Colonie Belge,* IV (1923): 303.

roughest sort of speculation can be offered for the long pre-Belgian period. In general, the gradual absorption and displacement of the older Pygmy groups by southward-moving Bantu tribes that proceeded for many centuries may have brought about a slow rise in population as a somewhat higher culture replaced an extremely primitive one. There is no way of estimating how large this population may have been when the Congo was discovered by the Portugese toward the close of the 15th Century. For almost another four hundred years direct European dealings with the region were restricted to the mouth of the Congo River. As a factor in population growth during this period, the introduction of new food crops

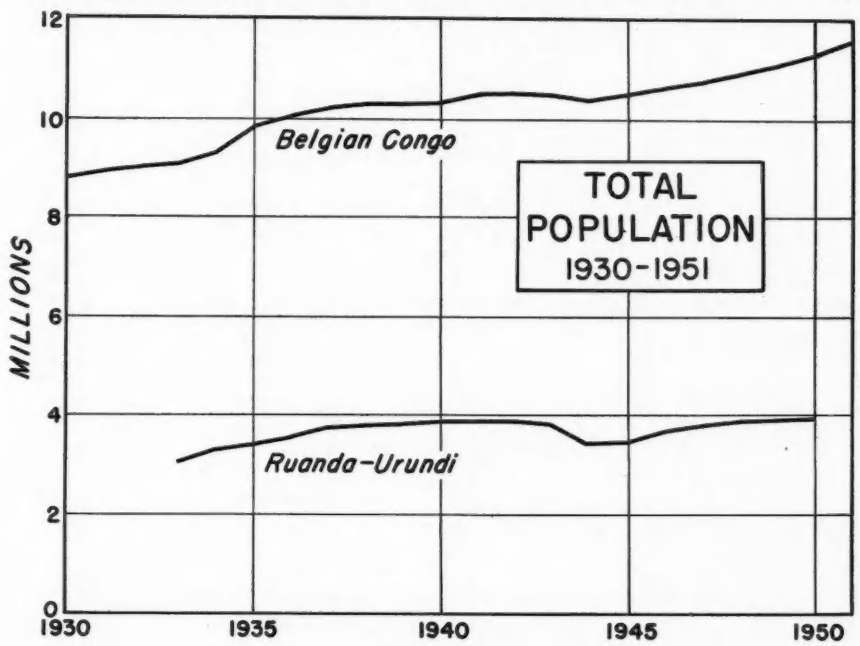

FIG. 1.

from America may have been cancelled out by the effects of new diseases imported from Europe and America.

Estimates as to the size of population on the eve of European occupation (circa 1885) are, at best, based on flimsy data, and at the worst are fantastic guesses. Stanley, for example, is quoted as estimating the population of the "upper Congo section" at 43 million in 1885. Consequently, the figure of 10 to 15 million for this earlier period, suggested by the most careful of the investigators, must be accepted with great caution.[9] The first years of European rule—the Congo Free

[9] A. Vierkandt, "Die Volksdichte im westlichen Central-Afrika," *Wissenschaftliche Veröffentlichungen des Vereins für Erdkunde zu Leipzig,* II (1895): 168–69.

State period of 1885–1908—constituted a period of reckless and dangerous exploitation of both natural and human resources which quite likely resulted in an absolute decline of population.[10] Even today it is possible to detect the unhappy character of that era in the demographic characteristics of the older elements of the Congo population.[11] The change from Free State to Belgian colony was associated with a general improvement of living conditions and, hence, probably an uptrend in population numbers. However, the heavy demands on Congo manpower shortly afterward during World War I are believed to have reacted unfavorably on birth rates and thus on total numbers. Although the creation of an administrative machinery made feasible certain rough approximations, the published estimates of total population for this period vary widely. It is uncertain whether Sir Harry Johnston's guess of 15,500,000 for the Belgian Congo in 1910 was any closer to the truth than the official estimates of 7,248,000 for the same year and 5,975,461 in 1917.

The official point of view is that the data shown graphically in Figure 1 are relatively accurate—that there has been a rather steady rise in numbers over the past two decades with absolute decreases occurring only during World War II when the insatiable demand for African labor and a severe famine in Ruanda-Urundi generated extensive population displacement and a drop in fertility. Actually, it is extremely difficult to determine how much of the apparent increase during the past twenty or thirty years is real and how much is due to a better administrative control of the area and to improved reporting.[12] It is evident that the past two decades have been the best that Belgian Africa has known in terms of social and economic conditions and that this improvement has been reflected either in a positive increase in population or, at the very least, in a retarded rate of decrease.[13]

Present and future population trends

There is less uncertainty about current population trends in Belgian Africa than about those of the past. An increasingly large volume of sample vital statistics gathered by the Belgian administration leaves little doubt that the African pop-

[10] Karl Hänel, *Der belgische Kongo.* Leipzig, 1944. p. 85–86.

[11] J. P. Bouckaert and R. Ruel, "Contribution a l'Etude de la Population du District de la Tshuapa," *Institut Royal Colonial Belge, Section des Sciences Naturelles et Medicales.* Memoires, Tome 21, Fasc. 3 (1952). p. 27.

[12] There is no reason to accept Hänel's cynical view that the figures have been deliberately doctored by the authorities for propagandist purposes, *op. cit.,* 86. The best informed unofficial opinion does, however, incline to the notion that the reported increases merely reflect an increasing efficiency in the technique of enumeration, Cf. J. Van Wing, S.J., "La Situation Actuelle des Populations Congolaises," Institut Royal Colonial Belge. *Bulletin des Séances,* XVI (1945): 596–97.

[13] It might be argued that past trends for the Congo as a whole could be extrapolated from the first-rate demographic data collected by FOREAMI (which do show a decided increase in recent years). The objection to this procedure is that the small area involved is atypical in most respects and has enjoyed unusual social, economic, and medical advantages.

ulation must be growing.[14] In the course of 1951, births and deaths were recorded for sample groups in all sections of the Congo, a total of 333,766 individuals in all, or roughly 3 per cent of the total population. For the great majority of the communities sampled births exceeded deaths; for the Belgian Congo as a whole a crude birth rate of 30.5 and a death rate of 22.5 were obtained; or a net annual rate of increase of 0.8 per cent.

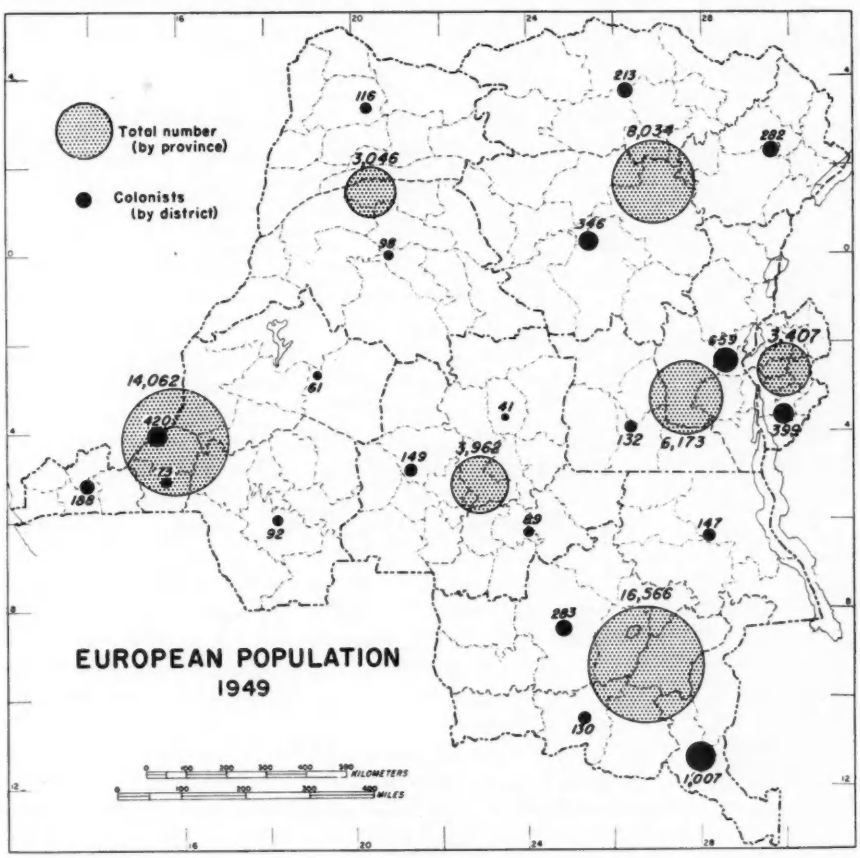

FIG. 2.

II. THE DISTRIBUTION OF POPULATION NUMBERS AND CHARACTERISTICS

The larger setting of the population of Belgian Africa

The distributional aspects of the Belgian African population cannot be fully

[14] Van Wing dissents from this view on the basis of personal observation, *Ibid.*, 599. The writings of all other observers, however, tend to bear out the implications of the official statistics.

appreciated unless they are viewed against the larger patterns of population in tropical Africa.[15] Three major population groupings may be recognized within tropical Africa: 1) a northern zone of large numbers and relatively high densities occupying West Africa from Senegal to the French Cameroons, 2) a Central African zone of sparse population and 3) an East African zone characterized by a

FIG. 3.

complex combination of high-density and low-density areas. Belgian Africa lies only within zones 2 and 3; much the larger part is included within the sparsely peopled Central African zone, with only the more densely populated northeastern part of the Congo and Ruanda-Urundi belonging to zone 3. It is certainly more

[15] Reference should be made to Figs. 1-a and 1-b showing population density and distribution for tropical Africa in "Population Patterns in Tropical Africa" by the authors of this paper, published in *Annals of the Association of American Geographers*, XLIV (1954): 135–162.

than coincidental—be it noted in passing—that the three empirically derived population zones should closely correspond to the three major culture areas of tropical Africa.

Population densities throughout the Belgian Congo range somewhat higher than those in the remainder of the Central African zone, with the sharpest contrasts appearing when the Belgian area is opposed to the adjacent portions of French Equatorial Africa and Angola. The abrupt contrasts that do exist along some exterior boundaries may be less real than the results of poor enumeration in the French and Portugese colonies.

Gross distributional patterns within Belgian Africa

Belgian Africa resembles other African lands in the great irregularity characterizing the distribution of its population numbers[16] (Figs. 4, 5, 6, 7). Within a pattern of decided peaks and ridges and of wide troughs of sparse settlement, nothing approaches the prominence of the extraordinary concentration in Ruanda-Urundi where a mere 54,170 square kilometers (20,930 square miles), or 2.3 per cent of the total area of Belgian Africa, contain some 25.2 per cent of its population. Scarcely any other tract of tropical Africa has so dense a clustering of population; and, indeed, only in a few world areas are such masses of rural people crowded into such small areas. The population patterns of Ruanda-Urundi are so different qualitatively as well as quantitatively from those in the Belgian Congo that it is virtually impossible to plot the two territories effectively on a single map using the same system of population symbols. For that reason—as well as because of certain incompatibilities in data sources—the two countries will frequently be represented separately in the figures accompanying this study.

Since half the large population of Ruanda-Urundi occupies only one-quarter of its territory, it is evident that there is an unusual concentration of people within a restricted area—more specifically the high plateaus of the central portion of the mandate. (Figs. 5, 7.) A belt of relatively sparsely settled land along the border between Ruanda and Urundi is one of the few breaks in this broad zone of densely populated territory stretching from Uganda southward to a point in south-central Urundi. A smaller but equally dense strip of population is to be found along the shores of Lake Kivu. Conversely, the northeastern edge of Ruanda, the whole

[16] Discussions of population distribution within Belgian Africa are to be found in: *The Belgian Congo.* Geographical Handbook Series, Naval Intelligence Division, Great Britain, 1944; Pierre Gourou, "Notice de la Carte de la Densité de la Population au Congo Belge et au Ruanda-Urundi," Institut Royal Colonial Belge, *Atlas Général du Congo* (Bruxelles, 1951); and Pierre Gourou, *La Densité de la Population au Ruanda-Urundi; Esquisse d'une Etude Géographique,* Institut Royal Colonial Belge, Section des Sciences Naturelles et Medicales, Memoires, Tome XXI, Fasc. 6 (Bruxelles, 1953). Both of Gourou's publications contain excellent maps in color; Belgian Congo and Ruanda-Urundi, Scale, 1: 5,000,000; Ruanda-Urundi, Scale, 1: 750,000. For detailed large-scale dot maps of population distribution see: Institut Géographique du Congo Belge, Congo Belge, "Répartition de la Population Indigène," six sheets plus an additional one for Ruanda-Urundi, Léopoldville, 1949, Scale, 1: 1,000,000; 1 dot to 500 persons.

south-eastern section of Urundi, the lands bordering lake Tanganyika, and the Ruzizi Valley in northwest Urundi are regions of much lighter settlement. Nevertheless, because of the intensive economic utilization of most of its surface, there is a greater evenness and continuity of settlement in Ruanda-Urundi than is true in the remainder of Belgian Africa.

Although sometimes of greater territorial extent, the remaining high-density areas of Belgian Africa are not to be compared to Ruanda-Urundi in size or density of population (Fig. 8). The two largest of these second-rank regions are Region 1, that wide band of well-populated savanna country running eastward from the Atlantic Ocean to the southeastern edge of Kasai Province, approximately between the 4th and 8th parallels, and Region 2, the densely settled western section of the Rift Valley and associated highlands extending from near Costermansville northward to the Anglo-Egyptian Sudan border (Figs. 4, 6). Both of these regions exhibit the nodular distribution of population characteristic of the entire country. In the case of Region 1, three sub-regions can be distinguished: 1-a, a zone of high density in the Bas-Congo from the vicinity of Léopoldville to Boma; 1-b in central and northern Kwango; and 1-c in central and southern Kasai Province.

At least seven other smaller but still extensive tracts of moderately to densely settled land can be detected in Figures 4 and 6: Region 3, the west-central section of Congo-Ubangi District; Region 4, a concentration well within the equatorial rain-forests of the central Congo Basin and one that straddles the Equateur-Léopoldville provincial boundary southeast of Coquilhatville near the confluence of the Congo and Ubangi; Region 5, a broken, semi-circular band of territory that follows the banks of the Congo from near Lisala to Stanleyville and then swings southwestward into the center of the Congo Basin; Region 6, the southeastern part of Uele District; Region 7, a narrow strip running southeast through the mining region of Maniema District to an area just across the border with Katanga; Region 8, a section in northeastern Haut-Lomami District in Katanga, mostly within Mwanza Territoire; and Region 9, the almost wholly urban concentration in the mining country of Upper Katanga. The smaller tracts of dense settlement that can be noted on the population maps need not be described here.

Although the densely settled areas attract most attention, it must not be forgotten that a great deal more than half the surface of the Belgian Congo is thinly occupied. A good 10 per cent of the country is virtually uninhabited; and, according to Gourou, the 69.8 per cent of its area which contains less than 4 persons per sq. km. (10.4 per sq. mi.) accounts for only 27.2 per cent of the total rural population.[17] Although lightly settled tracts occur within and among the denser areas, the bulk of this emptier land is contained in a few extensive regions. The largest of these, Region A, comprises the greater part of the "cuvette centrale," the central portion of the Congo Basin, and extends from the French frontier eastward between 2°N and 4°S across the whole breadth of the country to its well-peopled eastern border. Even with its few nodes of dense population, the high plateau of

[17] Gourou, "Notice de la Carte," 3.

Katanga Province (Region B) emerges as another extensive area of thin settlement. Other notable regions of low density are those in southern Kwango (Region C) and northern Uele District (Region D).

The large-scale details of population distribution

Except in Ruanda-Urundi and the northeastern marches of the Belgian Congo where settlement tends to fill in broad areas, the regions of dense population are

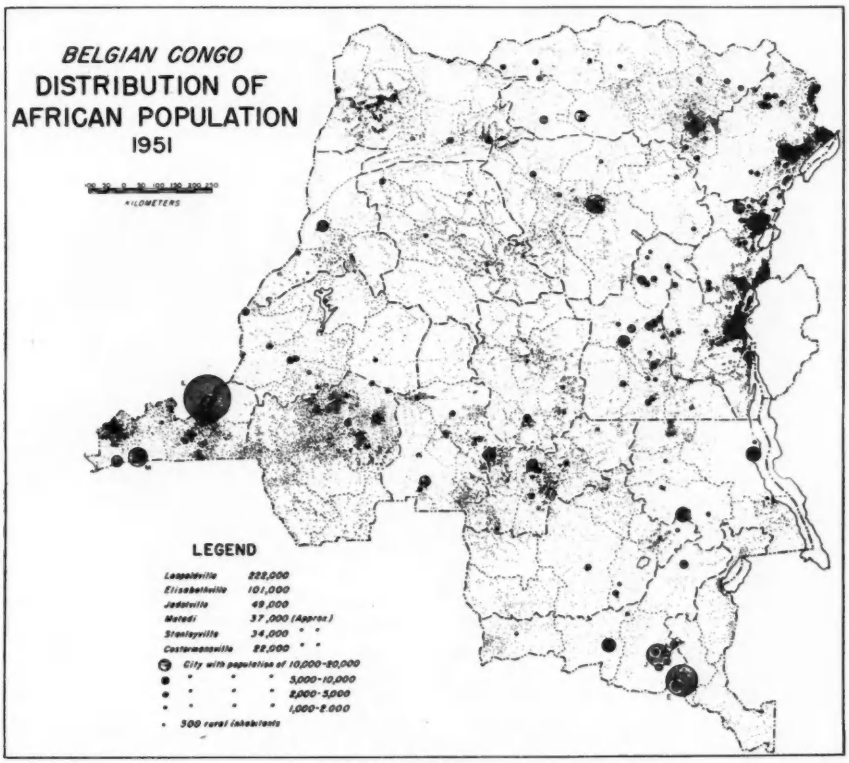

FIG. 4.

composed of long, narrow strips of thickly populated land that branch and twine in complex fashion (Fig. 4). At the points where these ribbon-like tracts meet, especially dense clusters of settlement may arise. This linear type of settlement is commonly associated with roads—and much less frequently with railroads—which, in turn, are laid out along valleys and interfluves, so that there is some correlation between areal patterns of population and the terrain. However, many apparently suitable settlement sites are unused. In fact, there appears to be no strong relationship between the economic potential of a given habitat and its actual population.

The ultimate details of population distribution are revealed through settlement size and spacing. Unfortunately, the only available data sources for settlement types in Belgian Africa, aside from scattered references in the literature, consist of a few large-scale topographic sheets and aerial photographs. What is certain is that the universal form of settlement in all of Belgian Africa, except Ruanda-Urundi and the adjacent sections of the Belgian Congo, is the small agricultural village. It may range in size from a small hamlet with perhaps no more than a half dozen families, to an agglomeration with several hundred individuals. There seems to be some variety in the forms villages may assume; the smaller ones tend toward a relatively compact shape while the larger settlements are often linear in form. In the apparently centerless linear village the huts are strewn in disorderly

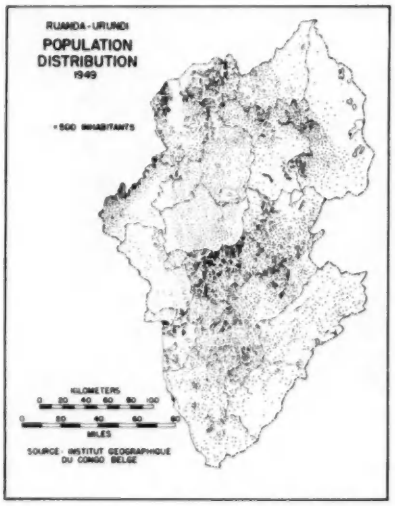

FIG. 5.

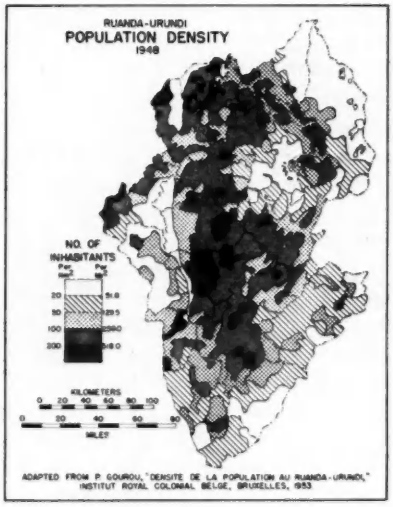

FIG. 7.

fashion along the sides of a road for distances of as much as a mile in close proximity to cultivated fields.[18] It is impossible to state whether there is any regional variation in village size or form. The little information available indicates that among the factors involved in the selection of village sites are proximity to water, shelter from wind, soil fertility, religious beliefs, and an avoidance of excessive aridity or moisture.[19] The majority of villages appear to be located either on interfluves or

[18] Photographs of such villages appear in Richard U. Light, *Focus on Africa.* American Geographical Society Special Publication No. 25. New York, 1941. Plate 204; and E. A. Gutkind, *Our World from the Air; an International Survey of Man and his Environment.* New York, 1952. Plate 59.

[19] R. De Beaucorps, *Les Basongo de la Luniungu et de la Gobari, Institut Royal Colonial Belge, Section des Sciences Morales et Politiques,* Memoires, Tome X (Bruxelles, 1942), 30 and Belgian Congo, Service des Affairs Indigènes et de la Main d'Oeuvre, *Le Problème du Logement*

on the upper portions of gentle slopes. One of the peculiarities of settlement in Central Africa is its semi-sedentary character. The type of agriculture pursued results in the temporary exhaustion of a parcel of land after several years. The shifting of cultivation to another site may mean the abandonment of the old village; but after enough years have elapsed the former fields and village may be reoccupied.[20]

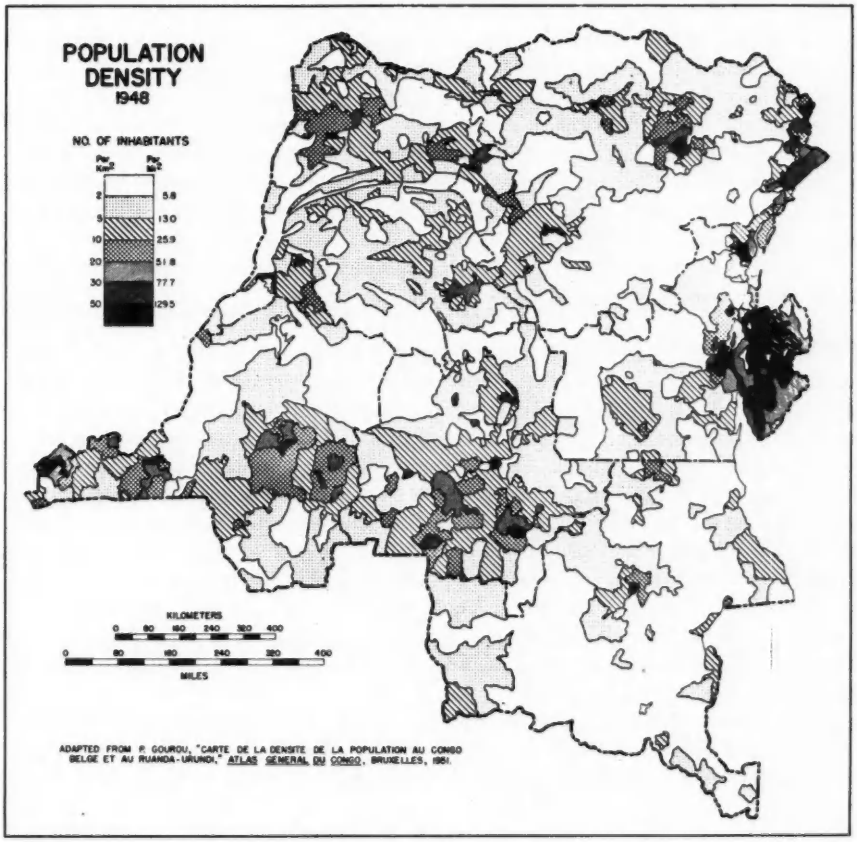

FIG. 6.

Within Ruanda-Urundi, and also along the eastern margin of neighboring Kivu

des Indigènes au Congo Belge, Regional Conference on Housing Research in Africa South of the Sahara (Pretoria, 1952), 5.

[20] Such, at least, is the case in the savanna country of Northern Rhodesia and Katanga. Cf. Audrey I. Richards, *Land, Labour and Diet in Northern Rhodesia; an Economic Study of the Bemba Tribe*. London, 1939.

Province in the Congo, the morphology of settlement takes on a radically different appearance, for the agricultural village is replaced by dispersed family dwellings and small, amorphous hamlets.[21] There is a strong tendency for settlement to be restricted to interfluves and even hilltops up to a certain altitudinal-thermal limit (roughly 2,200 meters). The reasons for dispersed settlement within this region are not clear.

Population density[22]

According to 1951 data, the average population density (i.e., population/gross area) of the Belgian Congo was 4.95 per sq. km. (12.82 per sq. mi.) if both urban and rural settlements are included, or about 4.4 per sq. km. if only rural population is considered. This figure is misleading insofar as it ignores the fact that only a small portion of the land is devoted intensively to the support of the population—probably less than 2 per cent at any given time. In Ruanda-Urundi, where almost one-quarter of the land surface is cultivated and most of the rest grazed, an average density figure of 72 per sq. km. (187 per sq. mi.) is more meaningful.

In such a predominantly rural area it might be assumed that the ratio, $\frac{\text{total population}}{\text{cultivated area}}$, would furnish a more ideal index to the man-land relationships in Belgian Africa than does simple arithmetic density. In reality, the official data on land cultivated by Africans are so unreliable, chiefly erring on the side of underestimation, that their value is seriously open to question. Moreover, the character of aboriginal agriculture also presents difficulties in delineation and measurement, for while only a small area is used directly for crop production, by interculture methods it may contain more than a single crop per field, may be harvested more than once a year, and may be manured with vegetable matter collected from a wide area. In addition, it is difficult to construct an index that will take into account the large amount of land lying fallow at any given time.[23] The official 1950 data indicate that in the Belgian Congo as a whole there were 6.6 persons per hectare currently cultivated for food, or 660 per sq. km. (1,710 per sq. mi.). Superficially, this density may appear astronomical for a primitive population, but it is not impossible.

The average density figures for Belgian Africa cannot indicate the wide range in densities that actually prevails (Figs. 5, 7). Within the Belgian Congo land with less than the average national population density accounts for more than three-quarters of the total area, while there are immense tracts with less than 1 person to a square kilometer. Within the major population concentrations already described, average densities range generally between 10 and 20 per sq. km. (26 to 52

[21] *Plan Decennal du Ruanda-Urundi,* 15–20 and Leo Peeters, "Quelques Aspects de la Géographie Humaine dans le Bassin de la Haute Ulindi, Congo Belge," *Société Belge d'Etudes Géographiques, Bulletin,* XIX (1950) : 107 and Plate 2.

[22] This discussion is based on the excellent density maps authored by Pierre Gourou, *op. cit.* from which Figs. 6, 8 have been generalized.

[23] A detailed account of indigenous food production and land use practises appears in Richards, *op. cit.*

per sq. mi.) and only in a few small tracts in Bas-Congo and near Lakes Kivu and Edward are rural densities of more than 50 per sq. km. (130 per sq. mi.) achieved. Nowhere in the Belgian Congo, then, would the observer note any obviously overpopulated areas. The situation is far different in Ruandi-Urundi where over half the country has a density of 50 or more per sq. km. Gourou states the densities of 294 per sq. km. (761 per sq. mi.) prevail over 1.2 per cent of the country's area

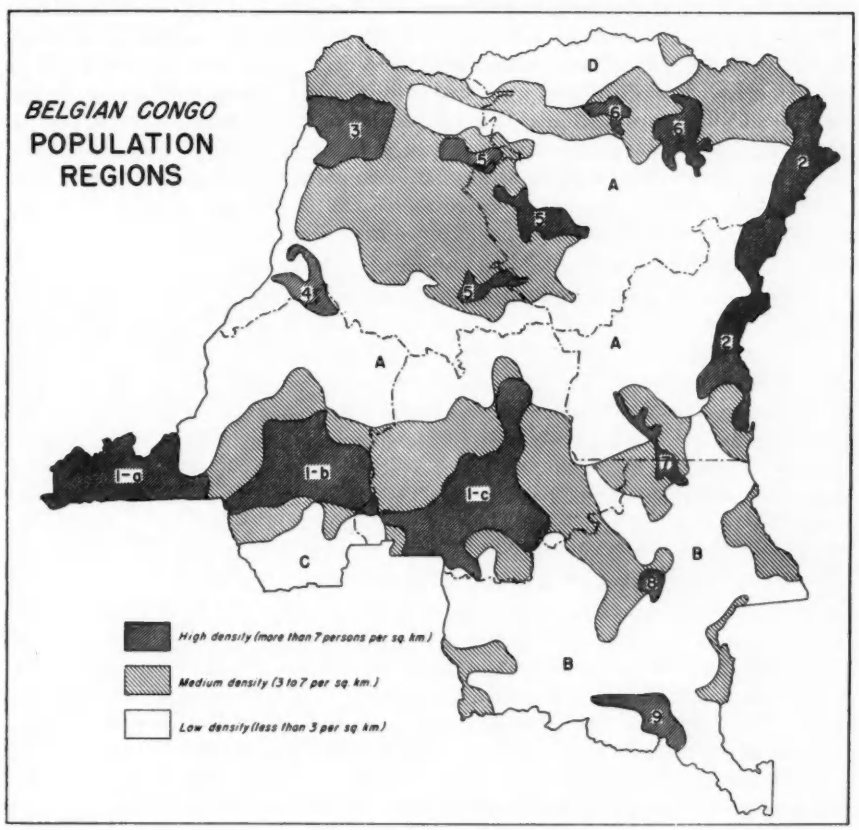

FIG. 8.

and that in some localities densities exceed 400 per sq. km. (1,036 per sq. mi.).[24] Such a concentration of rural population is nowhere approached in Europe or North America; it is equalled only within a few small regions of Africa and elsewhere in the world probably only in Monsoon Asia and the Caribbean region.

There is no arguing the fact that the Belgian Congo, unlike Ruanda-Urundi,

[24] Gourou, "Notice de la Carte," *op. cit.*, 4.

has not yet approached its full population capacity, even within the limits of aboriginal culture. Indeed, one of the Belgian administration's chief concerns has been the promotion of population growth in the Congo. There are, in all probability, considerable variations in the population potential of the various regions of the country, but they cannot be nearly as great as the observed disproportion between present-day densities in the population regions of the Belgian Congo, between the Congo and Ruanda-Urundi, and between the Congo and such culturally similar areas as Uganda, Nyasaland, and Nigeria. The explanation of an underpopulated Congo does not depend so much on any inadequacy in the material culture of its inhabitants as on an aboriginal social and political structure that has not encouraged rapid population growth and has failed to provide much incentive for increased food production.[25] Consequently, a prime factor in explaining differences in population density within Belgian Africa is the variation in social and political structure from tribe to tribe.

Population qualities and their distribution

Residence characteristics: tribal and non-tribal

Although the dichotomy between rural and urban settlement is as important in Belgian Africa as elsewhere, it is subsidiary to that more meaningful division of the African population into tribal ("en milieu coutumier") and non-tribal ("hors du milieu coutumier"). The definition of tribal population is self-evident. Non-tribal Africans, most of whom are regularly employed adult males and their dependents, live away from the native village either temporarily or, in an increasing number of cases, permanently.[26] A large floating population of detribalized Africans only intermittently employed must also be included under the latter category. Statistics on the size and distribution of non-tribal population are inadequate for the period before 1945, but from a total of 1,565,000 in that year the number has grown to 2,342,000, or 27.1 per cent of the total population of the Belgian Congo, in 1951, and a doubling in size during the past fifteen years is not unlikely. In Ruanda-Urundi the evolution of this group is much less advanced because of the slower economic development by Europeans of that subdivision. The official data do not distinguish rural and urban population, but it is probable that at least 1,400,000 of the non-tribal Africans (who form the entire African urban population) reside in urban centers with a population of 1,000 or more,[27] while the remainder live in villages other than their own or in special rural housing furnished by employers.

Urban population

The growth of Belgian African cities (non-agricultural centers with 1,000 or more inhabitants) has been, perhaps, the most spectacular of the recent demo-

[25] This matter is discussed most searchingly in Richards, *op. cit.*, 398–405.

[26] A good general survey of recent changes in the social structure of partially Europeanized Africans is given in Jacques J. Maquet, "The Modern Evolution of African Populations in the Belgian Congo," *Africa*, XIX (1949) : 265–272.

[27] Gourou estimates the 1948 urban population at 1,205,797, "Notice de la Carte," 2.

graphic developments in that region.[28] The strong cityward drift of the Congo's rural folk—mostly young adults, with a preponderance of males—has paralleled that of almost every other nation in modern times. But the cities of Central Africa do differ markedly from those of many other regions in the fact that the Bantu populations of the region had nowhere succeeded in building settlements of greater complexity than the agriculutral village before the coming of the Europeans.[29] All the 167 cities of the Belgian Congo and the 14 of Ruanda-Urandi[30] were located, planned, and built by Belgians[31] with Africans playing a passive role (Fig. 4). In most instances, the location of a city has been dictated by highly practical economic considerations, the great majority being placed at strategic points in the transportation network—at river confluences, rail junctions, and the points where water and rail transport meet. Most of the others are situated in mining areas. There are a few small ones which have developed primarily as administrative and missionary centers and whose locations are relatively arbitrary. In all, some 13 per cent of the Belgian Congo's total population and about 60 per cent of its non-tribal population, now reside in urban centers of 1,000 or more, and there is every reason to anticipate that a further rise in this percentage will accompany the continued development of the national economy.

Within Belgian African cities there exists a sharp spatial segregation of population on the basis of race, with the White minority occupying the commercial core and the central residential section of the city, and Africans restricted to outlying neighborhoods, some of them organized political entities. As of 1950, 41 of these spatially isolated African quarters constituted semi-autonomous legal entities: 8 "cités indigènes"—of which only Léopoldville contained more than 2,000 inhabitants—and 33 "centres extra-coutumiers." Within these organized communities streets are arranged geometrically and the houses built in quasi-European style. The many unorganized urban Africans reside in amorphous squatter settlements on the periphery of towns.

The distribution of non-tribal population

The distributional pattern of tribal population differs so slightly from that of the total population already described that it need not be discussed at this point. The story of the non-tribal population with its wholly different distributional pattern is, however, much simpler (Figs. 9 and 10). As already intimated, this pat-

[28] The most extensive treatment of urbanization in the Congo is Maurice Heymans, *L'Urbanisme au Congo Belge.* Bruxelles, 1951. Other discussions are to be found in R. Schoentjes, "Considerations Générales sur l'Urbanisme au Congo Belge," *Institut Royal Colonial Belge, Bulletin des Séances,* V (1934) : 534–60 and E. Devroey, "A propos d'urbanization au Congo Belge," *Ibid.,* XII (1941) : 146–73.

[29] Jean Dresch, "Villes Congolaises: Etude de Géographie Urbaine et Sociale," *Le Revue de Géographie Humaine et d'Ethnologie,* I (1948) : 3; and Gilles Sautter, "Aperçu sur les Villes 'Africaines' du Moyen Congo," *L'Afrique et l'Asie,* II (1951) : 40.

[30] As of 1948, Gourou, "Notice de la Carte," 5.

[31] Except for two or three towns at the mouth of the Congo which have been European trading centers for centuries.

tern is an index to European economic activity in Belgian Africa, for employment opportunities, in whatever region they may be, have always succeeded in attracting an African labor force. The mines, factories, plantations, ports, railroads, highways, administrative centers, and the large cities with their varied labor demands, have all drawn heavily from rural village populations. But the location of European enterprises has been determined only in small part—if at all—by the location of a potential labor supply. Two principal non-tribal groups are recognized, viz., those employed in urban places (60 per cent) and a rural group mainly employed on plantations.

A dominant role in locating European business enterprise has been played by the physical environment and the transportation system. This is most obviously the case for mining operations which account for the bulk of non-tribal Africans in Upper Katanga, eastern Orientale, much of Kivu Province, and the diamondiferous sections of Kasai Province. Climatic and soil factors combine with the even more critical matter of freight costs to explain the concentration of non-tribal people on plantations in Stanleyville, Congo-Ubangi, Tshuapa, Kwango, and Bas-Congo Districts, (Fig. 11) while the difficulties associated with exporting bulky goods have inhibited commercial development elsewhere. Because of their resources and locational advantages Katanga and Léopoldville Provinces have the most highly developed transport and manufacturing industries, a fact reflected in their labor force structure. The statistics on number of employees by class of industry—although available only by provinces—strongly support the foregoing explanation of the distribution of non-tribal Africans.

Sex ratio

Whatever the inadequacies of the data may be, it is universally agreed that Belgian Africa, like almost all other African lands,[32] has a deficit of males. This phenomenon, which is most pronounced among the adult population, is best explained by the fact that death rates are markedly lower among females throughout the entire African lifespan since the inherent physiological superiority of the female constantly asserts itself under the harsh living conditions of Belgian Africa. Regional variation in the total sex ratio (Fig. 12) is of great magnitude, with a range from 156.1 in the city of Léopoldville to 81.3 in Lubefu Territoire, Kasai Province.

But an even more meaningful picture emerges if children and non-tribal adults are eliminated (Fig. 13). The sex ratio among the former is rather uniform and of minor interest, while the extremely high sex ratios among non-tribal adults are precisely what would be expected for recent groups of migrants. Nothing in Figure 13 is more striking than the high sex ratios that prevail throughout the entire northeastern portion of the Belgian Congo. If the data can be accepted as being fairly accurate, then it must be admitted that there is no known combination of factors reasonably to account for the phenomenon. The mystery deepens when it is

[32] L. W. G. Malcolm, "Sex Ratios in African People," *American Anthropologist*, XXVI (1924): 454–73 and G. Lefrou, *Le Noir d'Afrique*. Paris, 1943. pp. 306–10.

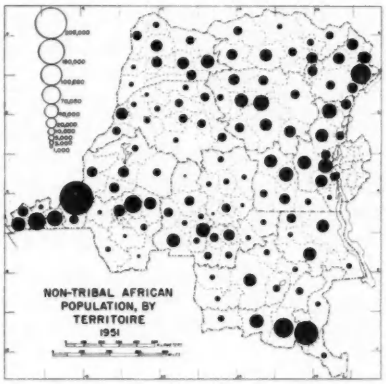

FIG. 9.

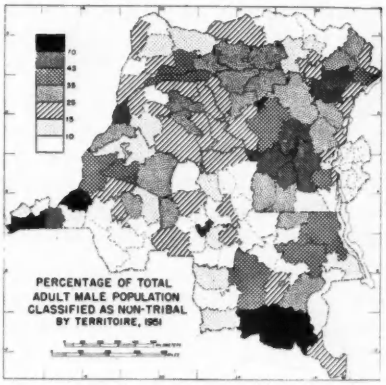

FIG 10.

realized that the differential between the northeastern areas and the remainder of the country has, like other regional variations, persisted for a considerable length of time.

It will be seen subsequently that regional differences in mortality are too poorly understood to be invoked in a genetic factor in the distribution pattern of sex ratios; but the regional variations in the out-migration of young males have decidedly contributed to the origin, or at least the accentuation, of this pattern. Thus Regions A and B, where sex ratios are generally low, constitute areas with a strong outward flow of migrants, and such is the case also in Regions 1-a (where one territoire has the amazing sex ratio of 50.0) and 1-b. Conversely, Regions 1-c, 2, and 3 are areas with both higher-than-average sex ratios and slight out-migration (or even net in-migration). The problem of Ruanda-Urundi, which combines a relatively high sex ratio and also a heavy emigration, is related to that of high sex

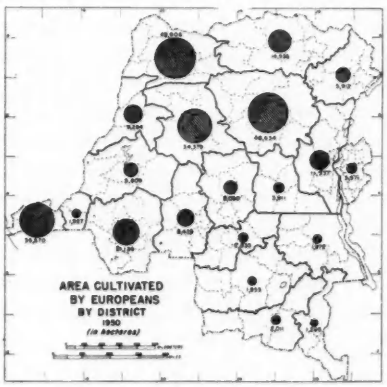

FIG. 11.

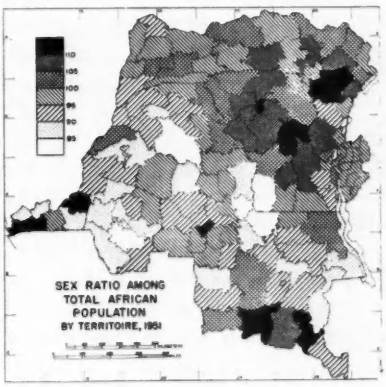

FIG. 12.

ratios throughout the northeastern Congo. Even less comprehensible are the high ratios found in scattered territories within Katanga Province.

Regional variations in fertility

Although a large literature has arisen on the subject of fertility in Belgian Africa, its statistical basis is rather meager and unreliable. The nominal system for the registration of births by government officials has proved to be ineffectual, so that the data on hand consist mainly of a series of sample studies. The most extensive among these is conducted annually by the government and now covers over 3 per cent of the total population, including inhabitants of every one of the territoires. Other statistics have been contributed by FOREAMI,[33] urban administrations, and a small group of medical scholars and missionaries who have painstakingly studied individual communities.

It is interesting to note that the national averages for Belgian Africa do not support the widely held notion of unusually high birth rates among primitive tropical peoples. The Belgian Congo with an estimated crude birth rate of 30.5 in 1950 occupied an intermediate position among the nations of the world, above the more advanced nations of Europe and North America, but well below some nations in Asia and Latin America.

A glance at the governmental sample survey shows that there is great variation in crude birth rates from one section of the Belgian Congo to another—from Tshuapa District with its 18 births per 1,000 inhabitants in 1950 to Haut-Katanga with 48. The most striking differences are those among individual tribes with extremes of 6 per 1,000 for the Bakusu group of Kindu Territoire, Kivu Province, and 88 among the Banya-Ruanda tribe of Masisi Territoire within the same province. There are, in addition, numerous cases where a tribe may enjoy a birth rate two to four times greater than that of a neighbor.

The sum of all the evidence (and particularly the child/woman ratio shown in Figure 14) points persuasively to the following conclusions: The only regions whose fertility is high enough to make possible a rapid growth of population—other factors remaining at average levels—are Ruanda-Urundi, Regions 1, 2, and 3, the environs of Stanleyville, and the southeastern portion of Katanga. Throughout most of the cuvette centrale and Uele, as well as in scattered sections of Katanga and Kasai, fertility levels are so low as to denote rapid population loss and even the imminent disappearance of some groups. In the remaining areas of Belgian Africa—roughly those with between 100 and 140 children per 100 adult females—it is not clear whether fertility is adequate to maintain present numbers.

An explanation for the regional variations in fertility cannot be forthcoming at the present time. Direct evidence on the age structure of the population, a factor of much relevance to fertility, is lacking. Nutritional and health conditions must affect the fertility rate, but on these topics there is a dearth of regional data. Quite

[33] In an annual series the most recent number of which is *Rapport sur l'Activité durant l'Année 1950*. Bruxelles, 1951.

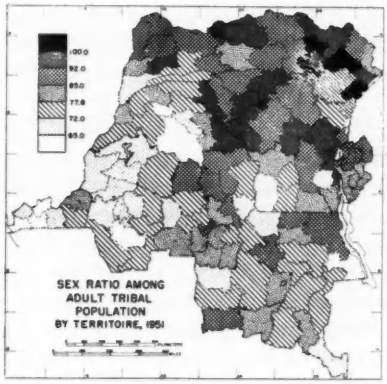

FIG. 13.

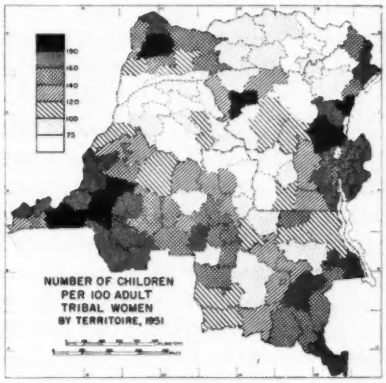

FIG. 14.

possibly, however, the high fertility pattern of the Bas-Congo is related to the superior medical facilities and better economic conditions prevalent in the region. There is some evidence that fertility rates are higher among the christianized groups which now comprise over one-quarter of the total population, while, on the other hand, polygamy may have a depressing effect upon the fertility of non-Christian peoples. Without doubt, the cultural shock and social demoralization attendant upon the meeting of European and African cultures has had its effects upon the fertility pattern, but how the regional variations have been influenced is not known. Almost certainly permanent migration is a very significant factor as a cause of low fertility among tribal populations. A large cumulative number of young people have been lost permanently to the tribe by migration to non-tribal centers. Not only does this loss of the economically most important segment of the tribes react unfavorably on its agricultural prosperity and general *esprit de corps,* but the simple

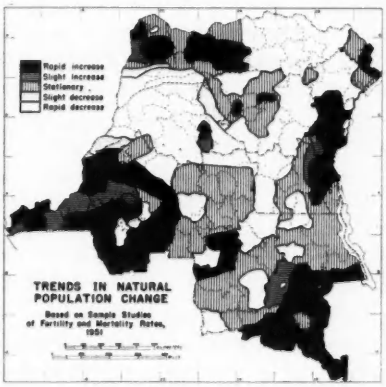

FIG. 15.

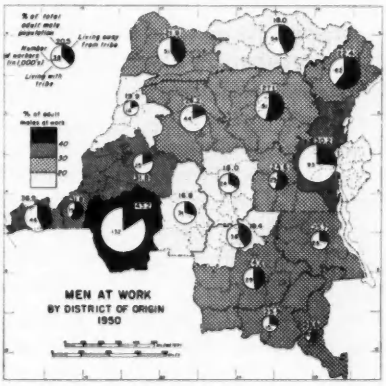

FIG. 16.

lack of potential parents results in a chronically low birth rate. A comparison of Figures 14 and 24 does indeed demonstrate that, while some exceptions exist, there is a decided correlation between zones of out-migration and those of low fertility.

Mortality as a factor in the population geography of Belgian Africa

Mortality data for Belgian Africa are even less abundant than those on fertility and far less subject to verification by indirect evidence. Actually, the official statistics on the subject afford less real insight into the distribution of mortality rates and causes of death than into the amount of progress registered by the Belgians in extending medical care to the African population.[34] However fragmentary the data may be, they indicate considerably less regional variation in death rates than in birth rates.[35] Moreover, the differences in death rates that do appear to exist among regions have little, if any, relevance to fertility, population density, population growth, or any other demographic factor. It must be concluded, therefore, that mortality is a factor of quite minor significance in the origin of present-day population patterns within Belgian Africa. Relatively uniform though it may be, Belgian Africa's average death rate of 22.5 in 1950 is high by world standards and helps explain the quasi-stationary status of national population totals during the past few decades.

Health and disease

A low state of physical well-being characterizes the native population of Belgian Africa and this condition of poor health seriously reduces their productive capacity. In part, this condition of poor health results from dietary deficiencies. In part, it is the result of numerous debilitating and lethal diseases which infest much of the area. From the scanty evidence available, it appears likely that the distributional patterns of the major diseases of Belgian Africa show few similarities and that they overlap in such a way that no one region or group of regions can be said to hold an advantage over the others in terms of "healthiness," unless it be the FOREAMI region with its superior system of medical care.[36] There are, however, some regional variations in major groups of disease, for infectious and parasitic diseases appear most frequently in the warmest and wettest provinces and respiratory dis-

[34] These statistics appear in the sample studies reported in *Rapport sur . . . Congo Belge* and in Congo Belge, *Rapport Annuel de la Direction Générale des Services Médicaux.* Although 1,845,015 Africans were treated for various complaints in 1951, only 9,472 deaths—or approximately 3.6% of the estimated total for that year—were recorded and tabulated as to cause of death.

[35] An examination of crude death rates for individual tribes, as gathered in the government's sample survey, adds further support to the contention that mortality is relatively uniform throughout the Congo.

[36] The best summaries of the medical geography of the region are Charles A. Flood and William Sherman, "Medical Care in the Belgian Congo," *American Journal of Tropical Medicine,* XXIV (1944) : 267–71, and James S. Simmons, et al., *Global Epidemiology; a Geography of Disease and Sanitation.* Volume Two. *Africa and the Adjacent Islands.* Philadelphia, 1951.

ease seems to be most prevalent in Kivu with its higher altitudes and in Katanga with its distinctly cool season.

Regional variations in natural population change

The addition of fertility and mortality statistics so as to provide an indication of net natural change in the population of Belgian Africa can be accomplished only in rather crude fashion since the available data pertain only to small sample populations. Nevertheless, when these data are tabulated and plotted (Fig. 15), some important facts appear: 1) there is a fairly good correlation between areas of rapid gain and those of high population density, and vice versa (Figs. 6 and 15); 2) there is an even better areal correlation between rate and direction of net natural change and fertility levels (Compare Figs. 14 and 15); and 3) hence, it can be concluded that fertility has been a much more potent factor than mortality in determining regions of natural population gain and loss and thus in the establishment of areas of dense and sparse population. The fact that there are some localities that belie the statements of correlation made above means that either the current areal patterns of net natural change are, in part, ephemeral or that the statistical basis for Figure 15 is too weak.

Migration

The Belgian administration does not make even a nominal attempt to record all migrational movements that occur within the colony, but the existence of labor force data (Figs. 16 and 17), migrational data in the sample survey of vital statistics, and brief remarks in official reports, plus the study of sex ratio distribution, location of tribal and non-tribal groups, and recent population changes make it possible to piece together a fairly coherent discussion of migration.

It is quite certain that the volume of migration crossing the international frontiers of Belgian Africa is much smaller than that which is internal in character, but the data concerning the former are so unsatisfactory that it is difficult to judge its absolute size or even to decide whether the outward flow of population from Belgian Africa exceeds immigration, or vice versa. International migration has been most important in Ruanda-Urundi which, partly because of its serious problem of over-population, furnishes a constant stream of migrants to nearby territories.[37] This movement reached its maximum during the drought and famine periods of 1944–45. In 1949, a normal year, there were 41,967 temporary emigrants (14,371 to the Congo and 27,596 to Uganda and Tanganyika), to which must be added an unknown number of permanent migrants directed mostly toward British colonies. Figure 18 shows that those laborers going to British territory were drawn from the eastern and central sections of Ruanda-Urundi, while the much smaller number of Congo-bound migrants originated in the more westerly areas. A comparable emigration is taken place from those thickly settled portions of the Belgian Congo

[37] R. R. Kuczynski, *Demographic Survey of the British Colonial Empire, Volume II, East Africa, Etc.* London, 1949. pp. 245–46, *et passim.*

bordering on Uganda; but this movement has by no means depopulated those areas. Within recent years the government has sponsored the mass relocation of groups from the most crowded sections of Ruanda-Urundi to the under-populated tracts within Kivu and Orientale Provinces of the Congo.[38]

In contrast to Ruanda-Urundi, the Belgian Congo as a whole has experienced a net gain of unknown proportions from international migration. This immigration has been funneled almost wholly into two small districts—the Léopoldville

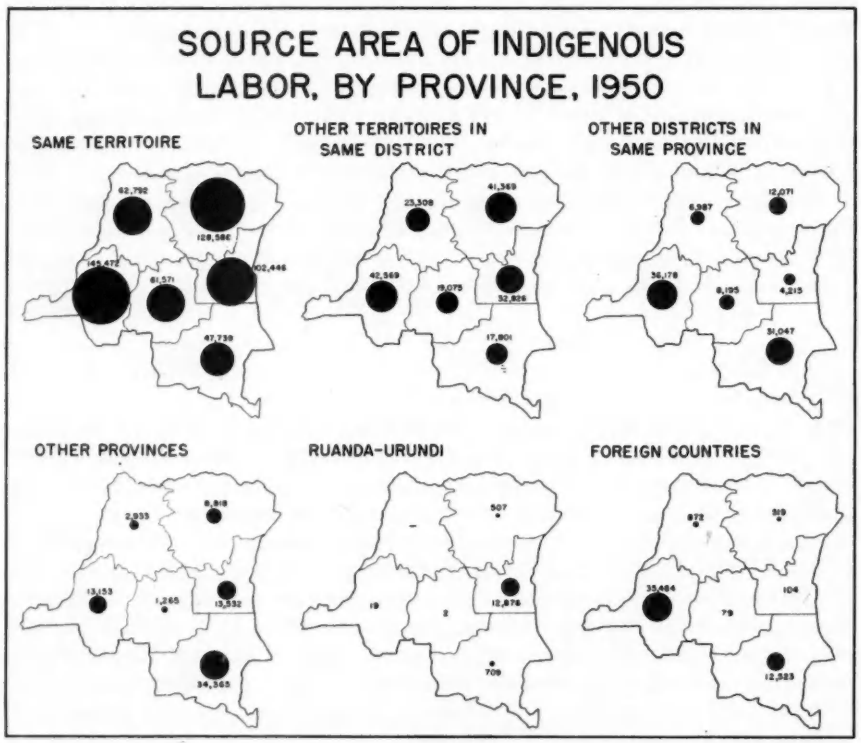

FIG. 17.

metropolitan area and the Katanga mining centers (Fig. 17). It is claimed that at least one-quarter of the population of the capital has been drawn from Angola and French Equatorial Africa,[39] and a few migrants have arrived from such distant points as Senegal, Dahomey, and Nigeria.[40] Katanga's foreign-born population is

[38] G. Tondeur, "Surpopulation et Deplacement de Populations," *Bulletin Agricole du Congo Belge*, XL (1949) and Gourou, *La Densité de la Population au Ruanda-Urundi*, 184–187.

[39] Heymans, *op. cit.*, 61.

[40] Dresch, *op. cit.*, 19–20.

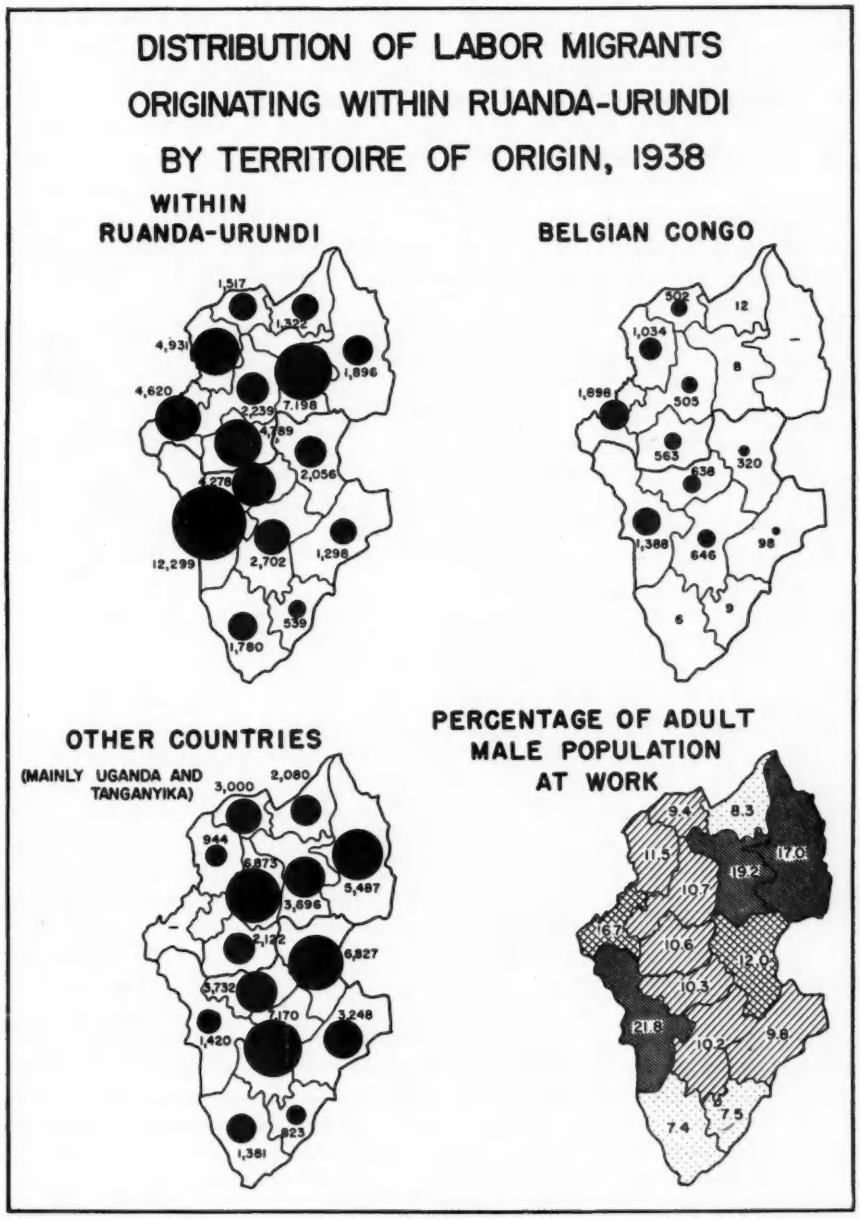
DISTRIBUTION OF LABOR MIGRANTS
ORIGINATING WITHIN RUANDA-URUNDI
BY TERRITOIRE OF ORIGIN, 1938
WITHIN
RUANDA-URUNDI
1,517
1,322
4,931
1,896
4,620
2,239
7,198
4,789
2,056
1,278
12,299
2,702
1,298
539
1,780
BELGIAN CONGO
502
12
1,034
8
1,898
505
563
638
320
1,388
646
98
6
9
OTHER COUNTRIES
(MAINLY UGANDA AND
TANGANYIKA)
3,000
2,080
944
6,875
5,487
3,696
2,122
6,827
3,732
2,170
3,248
1,420
823
1,381
PERCENTAGE OF ADULT
MALE POPULATION
AT WORK
9.4
8.3
11.5
17.0
19.2
10.7
16.7
10.6
12.0
10.3
21.8
10.2
9.8
7.4
7.5

FIG. 18.

largely Northern Rhodesian with only small contributions from Angola, Southern Rhodesia, Nyasaland, and Tanganyika.

Because of its much larger magnitude, the effect of internal migration on the areal patterns of population has been enormously greater than that of international migration. It is responsible for the creation of the large non-tribal group and has functioned strongly, if negatively, in the evolution of tribal populations. Although

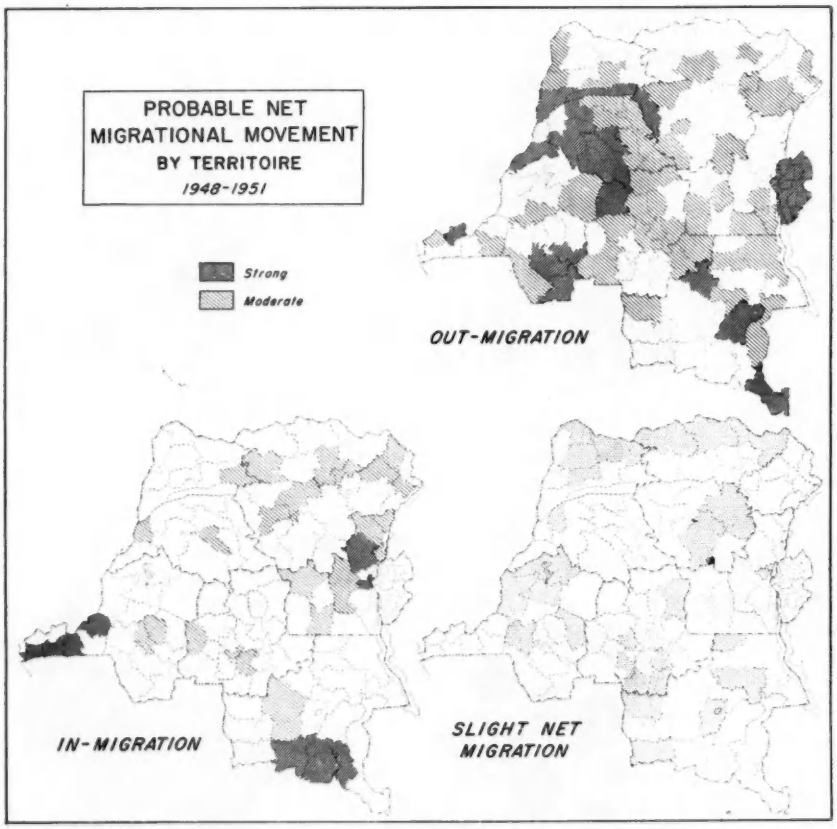

FIG. 19.

a steady increase in the volume of labor migration is readily proved and the sample survey has shown a rather high degree of mobility among Africans, with between 3 and 4 per cent of the total population performing some sort of move annually, the only reliable index to the amount of permanent migration is the growth of the non-tribal population. The importance of migration has varied greatly from area to area as shown by a study of sex ratios, the ratio of tribal to non-tribal groups,

and recent net population changes (Figs. 22–27). It must be understood, however, that because of the nature of the data, these results are relative, not absolute values (Fig. 19). Four regions appear to attract large numbers of migrants (mainly, as will be seen, from nearby territoires and districts): the Bas-Congo, the Léopoldville urban area, and the mining regions of Kivu and Katanga. Of lesser importance in terms of in-migration are the mining areas of eastern Orientale and various provincial centers throughout the country. Much the greater part of the Belgian Congo is characterized by internal net out-migration, with the largest exodus occurring in Regions A, B, and C. In the case of Regions 1-b and 1-c and a tier of territoires at the northern edge of the country, migrational movement appears quite sluggish.

A study of the source area of workers by province (Fig. 17) shows that the bulk of the labor force—and, by implication, all migrants—have moved to points within their native territoire or district and that only a small minority have crossed district or provincial boundaries. The journey of migrants in Bas-Congo and Stanleyville Districts and in Kasai Province appears to be especially short, but the Katanga labor supply seems to have been drawn from an especially wide area (because of the low density of population in that province?) with a sizeable fraction from Kasai.

It is noteworthy that nearly all major regions of net in-migration enjoy positive rates of natural population change and that migration merely accentuates a preexisting pattern. Conversely, most of the regions of strong net out-migration also suffer from both low fertility and relatively sparse settlement. As already indicated, the steady drain of out-migration has not only appreciably reduced the total population of extensive areas, but it has also meant an especially severe depletion of the ranks of potential parents. Ruanda-Urundi is the most striking exception to the generalization that regions of strong net out-migration characteristically are also regions of low fertility and relatively sparse settlement. Other exceptional areas are the rural districts of southeastern Katanga which have been able to maintain high fertility (at least until recently), while simultaneously populating nearby cities and labor camps, and Tshela and Luozi Territoires in Bas-Congo.

Merely to describe areas and routes of migration does not go far toward explaining the phenomenon. The reasons for areas of in-migration being where they are have already been explored, but no clue has as yet appeared as to why one region should be more willing to furnish emigrants than another. Although the factors of distance and economic necessity play their part, it is plausible to assume that an even more crucial consideration is the internal social and political stability of the tribes involved—that members of a "going" culture are more reluctant to leave it, even temporarily, than those whose traditional world is crumbling about them. Further development of this thesis requires more knowledge of the sociology of Belgian Africa than is yet available.

III. AN INTERPRETATION OF POPULATION CHANGE AND DISTRIBUTION

In a previously published paper, "Population Patterns in Tropical Africa," the authors have briefly sketched some of the more important genetic elements explain-

ing the arrangement of population numbers in tropical Africa in general. That discussion is applicable to Belgian Africa, but it will not be repeated for this particular fragment of the larger area. It remains here only to emphasize certain factors and elements of number change which seem to have been especially influential in producing the present pattern of native population as revealed in Figs. 4, 5, 6, 7. In order to appreciate present distribution it must be remembered that the whole irregular pattern of tribal settlement, resembling that of a jig-saw puzzle, is of relatively recent origin. Before the establishment of settled government, sudden and numerous migrations caused by distant wars, slave-raiding, famine, pestilence, and mere lust of conquest caused a constant reshuffling of tribal areas. European administration has tended to freeze them in their present locations.

Changes in the distribution of population

The only feasible approach to an explanation of the tribal African population regions is through an analysis of those changes in number distribution within recent years whereby regions of high and low density have originated or persisted. The background of the mechanics of population change has already been suggested in the discussions of contemporary fertility, mortality, and, especially, net population change, but it is necessary now to reach back farther into the earlier years of Belgian rule.

With the help of early studies of the population geography of Central Africa[41] and the Belgian statistics of 1919, it is possible to postulate several probabilities about the relative distribution of population during the early part of the Twentieth Century. Then, as now, Ruanda-Urundi and the neighboring portions of the Belgian Congo were densely occupied; Region 1-c was more thickly populated than the remaining regions of the country; and the region around the mouth of the Congo was another area of relatively dense population. It is possible, but not nearly as certain, that certain stretches of the middle Congo Valley, largely included within present-day Region 5, (Fig. 8) between present-day Stanleyville and Coquilhatville, may have been well peopled. There is no doubt about the existence of two large tracts of sparse population: the cuvette centrale and the high savannas of Katanga. The latter, in particular, appears to have been virtually uninhabited.

The population data for the Belgian Congo have been plotted in the form of density figures for districts at irregular intervals from 1919 to 1951—the only years for which statistical information is available (Fig. 20). With all its serious limitations in data, this map does portray some interesting long-term trends and conditions.[42] The three regions already described as being well-peopled before 1919—

[41] Vierkandt, *op. cit.*, and Karl Rehm, "Das Problem der Bevölkerungsschätzung Afrikas," *Geographischer Anzeiger*, XXIX (1928): 361–371.

[42] It would have been vastly preferable if *net change* could have been plotted either for the whole span of time involved or for a series of regular intervals. Such a procedure would greatly facilitate comparisons between different years for particular areas and would provide a simple overview of relative rates of change among the various regions of the Congo. It was rendered impossible by the fact that not a single district has retained its boundaries intact from 1919 to 1951. There are further complications in the uncertainty of some political boundaries and the flagrant inaccuracy of certain population figures, e.g., eastern Kivu in 1919.

Regions 1-a, 1-c, and 2 (Fig. 8)—appear to have gained steadily during the following decades. Two regions that were lightly settled in the early years of the Twentieth Century—Regions 1-b and 3—have registered continuous and spectacular advances, at least quadrupling their population in each case, if the data can be believed. Another region—Katanga Province—has experienced more moderate but

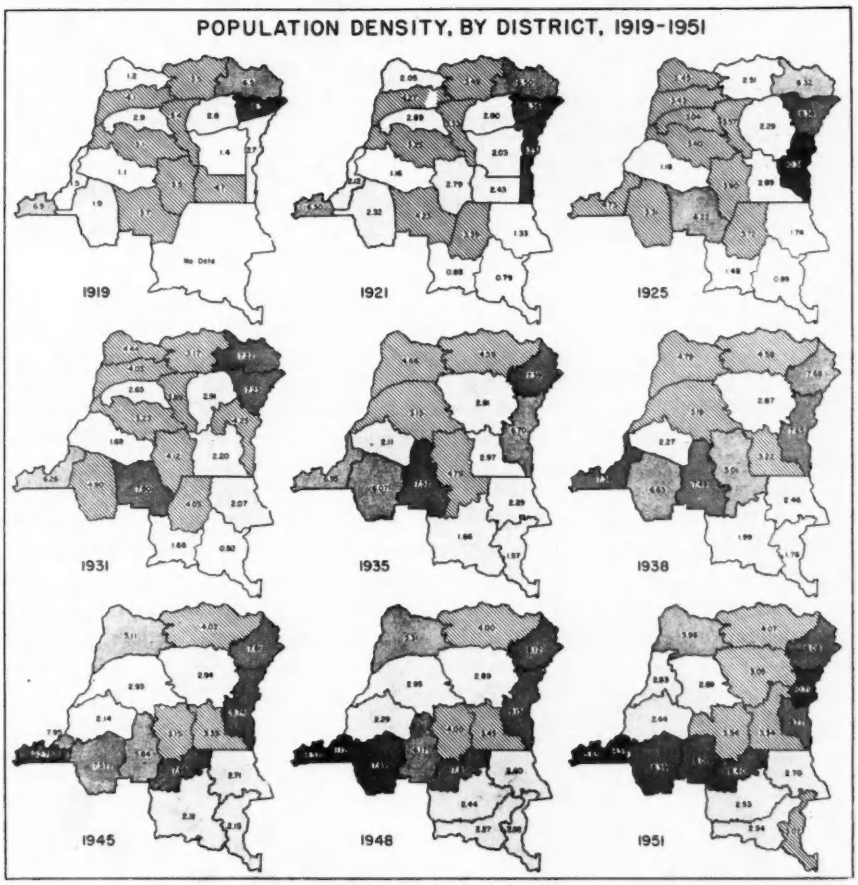

FIG. 20.

nonetheless steady increases over the past three decades. In contrast, the cuvette centrale has been much less progressive demographically; although the figures indicate that an overall increase has occurred, there have been absolute declines during some intervals and it is not unlikely that any apparent increase is illusory and due to improved enumeration. The same comment applies to Region D,

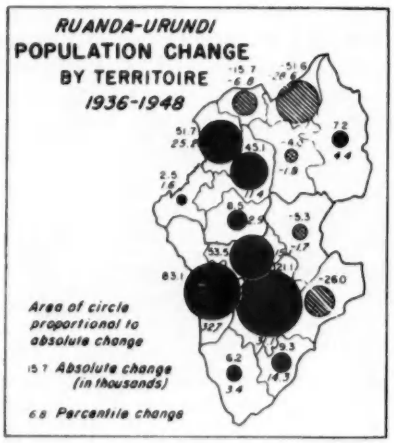

FIG. 21.

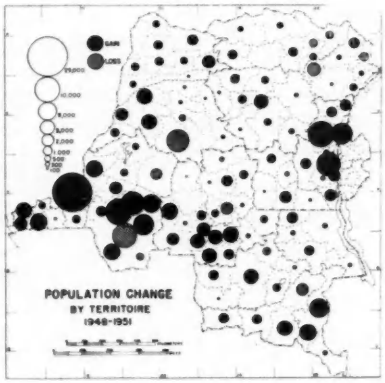

FIG. 22.

always the classic example in sociological writings on the Congo of an area in the throes of depopulation. It may be noted in passing that the shifts in distributional pattern within the Belgian Congo in the first half of this century seem rather extensive.

The stability of its administrative boundaries since 1936, when fairly reliable data on territoires began to be published, permits the construction of a map of Ruanda-Urundi showing both absolute and relative population change during recent years (Fig. 21). In general, it appears that there has been less extensive revision of earlier patterns than is the case for the Congo. Substantial increases were recorded for the relatively densely settled central and west-central sections, while the

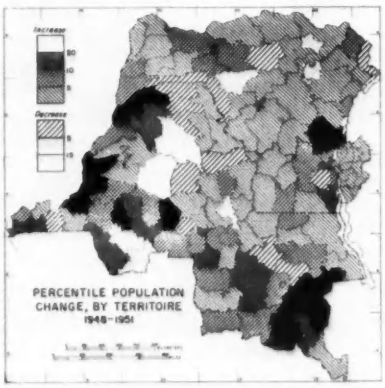

FIG. 23.

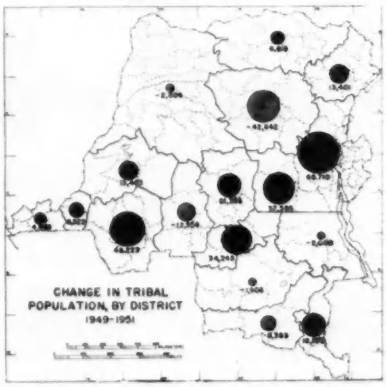

FIG. 24.

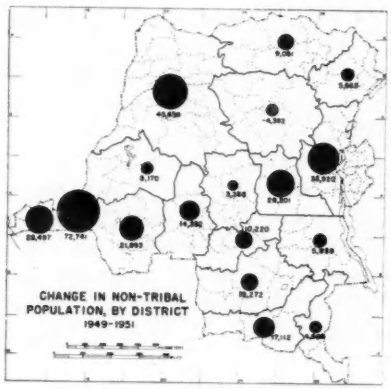

FIG. 25.

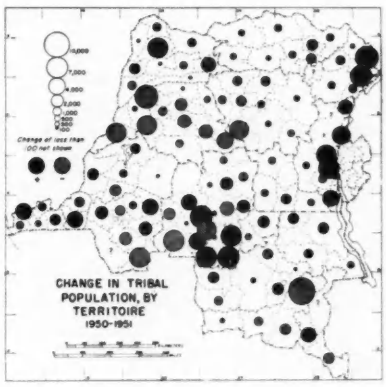

FIG. 26.

less populous districts along the northern, eastern, and southern margins of the country experienced slighter gains or absolute losses.

The publication of data on the population of territoires in the Belgian Congo since 1948, on the number of the tribal and non-tribal inhabitants of districts since 1949, and those within territoires since 1950, provides material for a more detailed regional study of trends in the distribution of population. It must be emphasized, however, that the very short time interval involved makes the recognition of trends difficult and hazardous.

A plotting of absolute and relative changes in total population by territoire for the period 1948–51 (Figs. 22 and 23) supports previous statements concerning long-term trends for major regions, since Regions 1, 2, 3, and much of Katanga show up as areas of decided gain, while Regions A and B are characterized by stagnancy or decrease. The use of territoires reveals the fact, invisible on Figure 20,

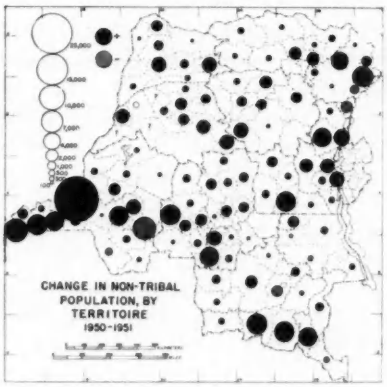

FIG. 27.

that the small inter-district Regions 4 and 7 have enjoyed sizeable increases. If any single conclusion can be drawn from these maps, it is that there is a tendency toward an increased unevenness in the distribution of population—and accentuation of already existing patterns—with populous areas gaining substantially and thinly settled regions either losing or barely holding population.

If the population of the Belgian Congo is differentiated into tribal and non-tribal for the two-year interval 1949–51 (and this can be done only by districts) (Figs. 24 and 25), it is seen that only Regions 1, 2, Haut-Katanga, and, rather unexpectedly, Uele District have been important gainers in tribal population, while Equateur Province, Stanleyville and Kasai District, and most of Katanga have lost. All districts have gained in non-tribal population except, unaccountably, Stanleyville, with Bas-Congo and Moyen-Congo Districts and Kivu Province making the most impressive progress.

Although it is possible to plot changes in tribal and non-tribal population by territoires only for an interval of one year—1950–51 (Figs. 26 and 27)—a quite revealing pattern is thus obtained. Only Regions 1, 2, 3, 7, and 8 appear to be augmenting their tribal populations, and even within them an occasional territoire undergoes loss; Regions A, B, C, and D are suffering a heavy drain on already depleted tribal groups. It seems that whatever slight gains Regions 4, 5, and 6 are currently experiencing are explained by increments of non-tribal population. The growth of non-tribal population is general, but the unusually large increases in the region between Léopoldville and the sea are outstanding.

The origin of the population regions of Belgian Africa

The following broad conclusions can be drawn from the preceding analyses of population change and of factors underlying the phenomenon: 1) there is a strong positive correlation between rate and direction of population change and the level of population density, and also between population density and fertility; 2) there is, consequently, an increasing accentuation of high and low density areas on the population map of Belgian Africa; 3) the principal elements involved in population change and the evolution of population regions are, primarily, differential fertility and, secondarily, internal migrations; and 4) there is little indication in the material thus far presented as to why areas of high and low fertility should be situated as they are and why some areas have lost a larger volume of population by out-migration than have others.

It is clear, now that the dynamics of change have been studied, that the whole problem of the origin of Belgian African population regions is reduced, finally, to the matter of the fertility and migrational characteristics of the various tribes inhabiting the country. It is only begging the question to point out that these characteristics are, in turn, determined by the internal social and political strength of the tribes and by the differential impact of European culture.

In order to summarize as briefly as possible the demographic characteristics of the several population regions of Belgian Africa these materials have been arranged

in the form of a table with the densely populated regions in one grouping and the lightly settled areas in another.

Accepted November 1953.

BELGIAN CONGO AND RUANDA-URUNDI.
RESUME OF GENETIC FACTORS INVOLVED IN POPULATION GROWTH, BY POPULATION REGION

Region	*Factors*
	1. RELATIVELY DENSELY SETTLED REGIONS
Ruanda-Urundi	High birth rate. Average sex ratio. Heavy emigration to other areas. *High child/woman ratio. Slight Europeanization.*
1-a	*Moderate to high birth rate. High child/woman ratio.* Low sex ratio. *Good health conditions. Low death rates. Large percentage of Christian marriage. Little polygamy. Long period of acculturation.* Heavy out-migration of tribal population. *Heavy in-migration of non-tribal population.*
1-b	*High birth rate. High child/woman ratio.* Low sex ratio. *Slight out-migration.*
1-c	*High child/woman ratio.* Average sex ratio. *Slight out-migration.*
2	*High birth rate. High child/woman ratio.* Large out-migration of tribal population. *Moderate in-mirgation of non-tribal population.*
3	*High child/woman ratio. High sex ratio. Little polygamy.*
4	Low birth rate. Low child/woman ratio. Average sex ratio. *Low death rate. Little polygamy. Slight out-migration. Moderate in-migration.*
5	Average child/woman ratio. *High sex ratio.* Heavy out-migration.
6	Low birth rate. Low child/woman ratio. *High sex ratio. Moderate in-migration.*
7	Low birth rate. Low child/woman ratio. Heavy out-migration of tribal population. *Moderate in-migration of non-tribal population.*
8	Low child/woman ratio. Average sex ratio. *Moderate in-migration.*
9	*High birth rate.* Average child/woman ratio. *High sex ratio. Little polygamy. Heavy in-migration.*
	2. LIGHTLY SETTLED REGIONS
A	Low birth rate. Low child/woman ratio. Sex ratio varies from high to low. Generally higher than average death rates. Heavy out-migration.
B	Average birth rate. Low to average child/woman ratio. Average sex ratio. Heavy out-migration.
C	*Average to high birth rate.* Average sex ratio. High death rate. Heavy out-migration.
D	Low birth rate. Low child/woman ratio. *High sex ratio.* High rate of polygamy. Slight out-migration.

NOTE: *Italicized factors are those conducive to population growth.*

THE WINTER FEEDING PERIOD IN THE SOUTHERN INTERIOR PLATEAU OF BRITISH COLUMBIA

THOMAS R. WEIR
University of Manitoba

GENERAL CHARACTERISTICS OF THE AREA

THE physiographic region referred to as the Interior Plateau of British Columbia extends centrally between the Coast Mountains and the Columbia Mountains for 500 miles (Fig. 1). The southern part of this region, desig-

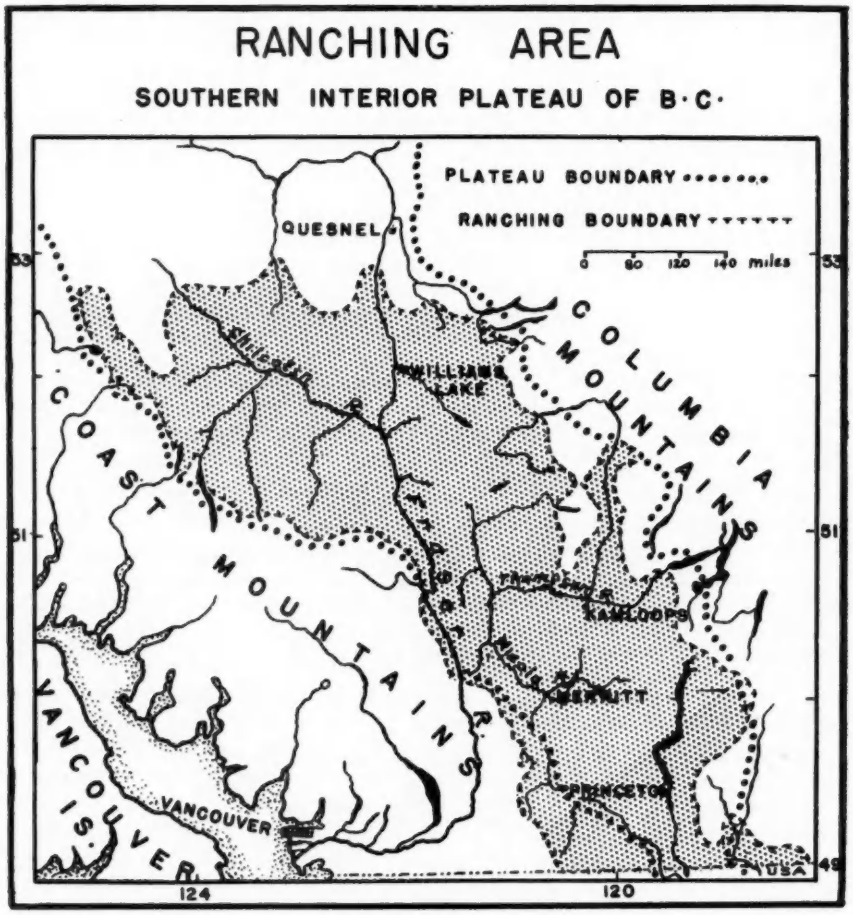

FIG. 1.

nated by Bostock the Fraser Plateau, extends from the international boundary northward to the divide between the Nechako and Chilcotin Rivers, tributaries of the Fraser.[1] This northern boundary follows generally the fifty-third parallel thereby giving an over-all length of approximately 300 miles to the Fraser Plateau. While the average width of the plateau is 100 miles, it is constricted by converging spurs of the Cascade and Monashee Mountains in the vicinity of the international boundary to no more than 30 miles. The area defined by these limits is approximately 30,000 square miles. With the exception of the Okanagan Valley, it is given over primarily to the grazing of livestock.

With the subsiding of the Cariboo gold rush after 1865, cattle ranching became the dominant industry and has remained so to the present. A conservative estimate places the number of cattle, exclusive of those in the Okanagan Valley and boundary districts to the east, at 100,000 head, making the southern Interior Plateau Canada's second cattle ranching area.[2] This number is distributed over approximately 420 commercial ranch units.[3] Although the average number of cattle per ranch is 170, twelve units keep from 1,000 to 5,000 head and one has 10,000 head.

Under the system of tenure which has evolved in this region, all ranch units own or lease choice grazing and hay lands. In addition they secure under permit of the government the right to graze a specified number of cattle on public domain land during the summer. Under this system more than half the total range is grazed in common. A typical ranch thus owns or leases from 3,000 to 4,000 acres and obtains the use of three or four times this area through government permit. The Gang Ranch in the Chilcotin district controls through ownership, lease and permit 1,000,000 acres; it is one of the largest ranches in terms of area on this continent.

SIGNIFICANCE OF THE WINTER FEEDING PERIOD

The outstanding problem facing the rancher is the length of the winter feeding period. The problem may be stated as a deficiency in bunchgrass range, particularly winter range, which is so limited that not more than five per cent of the cattle can "rustle" all winter. Less than ten per cent of the commercial units possess even a small amount of winter range. As a result nearly all ranchers must resort to the feeding of hay and, to a limited extent, of grain for a period varying from a few weeks to six months (Fig. 2).

The relationship between the length of winter feeding and the ranch economy is critical since the cost of putting up hay is the largest single item of expense which has to be faced. The shorter the feeding period is, therefore, the lower is the cost of producing beef. This may not appear to be of acute concern when market

[1] H. S. Bostock, *Physiography of the Canadian Cordillera*. Geol. Surv. Canada, Memoir 247, 1948. p. 41.

[2] Estimate based on reports of the B.C. Cattlemen's Association, 1950. District agriculturalists estimate the total to be 165,000 head (1950). Grazing permits issued for this area numbered 77,174 in 1948.

[3] A commercial unit is defined as one keeping more than 24 head of cattle and depending mainly on extensive cattle raising as the basis of subsistence.

prices remain high, but a sudden decline in the value of beef causes the operations of some establishments to fall below the economic margin of safety. The length of the winter feeding period on a given ranch unit is reflected in the value of the land, the number of head it can sustain, and the ranch practices followed. Those units with a long winter feeding period tend to operate closest to the economic margin, often combining ranching with logging or catering to tourists and hunters. The larger and more prosperous units are located in areas of short winter feeding period.

FIG. 2.

The problem of winter feeding is not controlled entirely by market price. Variation in the hay supply from year to year occasionally results in acute shortages, with the undesirable alternatives of having to market beef in poor condition or to pay exorbitant prices for imported hay. Such occasional disastrous shortages are directly related to seasonal weather conditions. Those ranches located on the up-

lands and dependent on wild hay must have adequate spring rains to flood the meadows, followed by a dry summer to permit their draining and cutting. On the other hand those ranches in the lowlands where a semi-arid climate makes irrigation a necessity require adequate precipitation in the watershed areas to bring about a dependable flow of water in the dry season. Irregularities in total amount and sea-

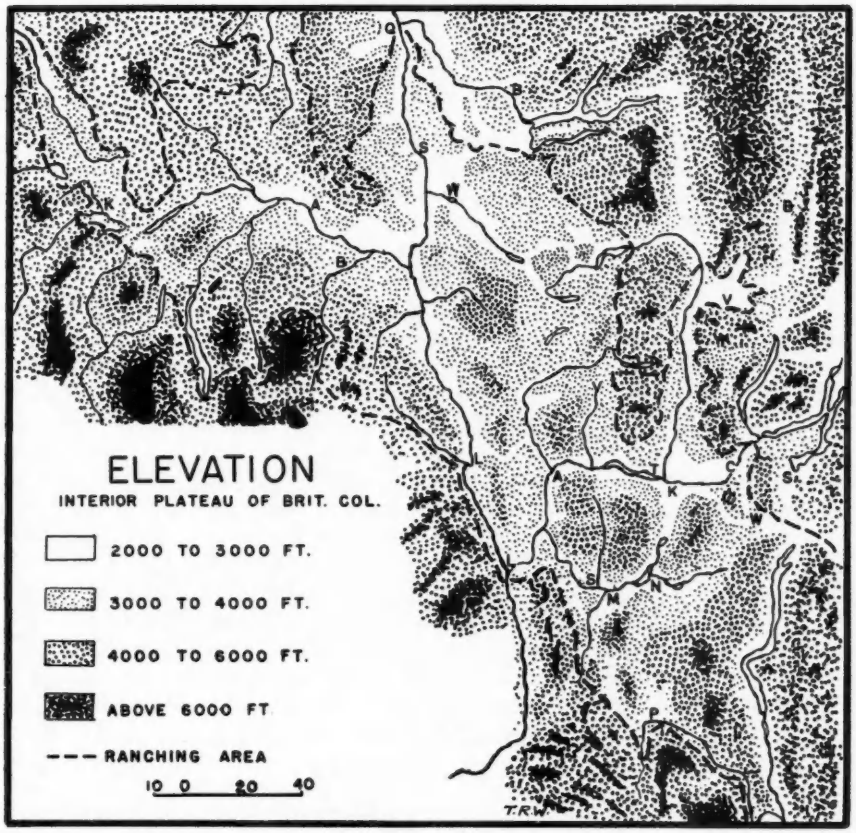

FIG. 3.

sonal occurrence of precipitation greatly affect the problem of winter feeding and occasionally spell disaster.

PHYSICAL FACTORS AFFECTING THE WINTER FEEDING PERIOD

Though both physical and economic factors are closely associated in the problem of winter feeding, it is possible to isolate the former in terms of climate and native vegetation. These in turn are related to topography, the primary factor.

The Fraser Plateau slopes from an average elevation of 4,500 feet in the south to 3,500 feet three hundred miles further north (Fig. 3). The unifying drainage feature throughout is the Fraser River. Through the plateau this stream flows southward against the direction of slope and, as a result, becomes increasingly entrenched. Thus the relief along the middle course of the Fraser is commonly

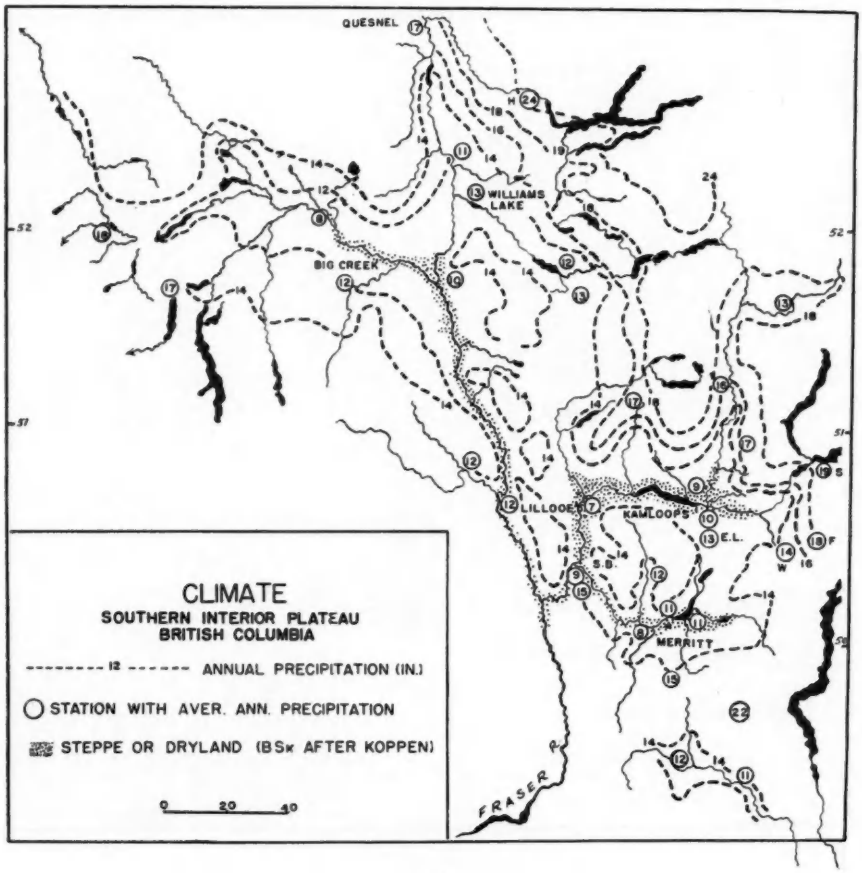

FIG. 4.

1,000 feet and reaches 4,000 feet in the vicinity of Pavilion Mountain. The major tributaries near their mouths show a corresponding entrenchment of several thousand feet as, for example, the Thompson River near Kamloops where the river is 3,000 feet below the adjoining upland. Major valleys are also broad and are flanked by several tiers of extensive terraces. These constitute ideal sites for cultivating

alfalfa and other hays, provided tributary streams lend themselves to the development of irrigation.

The surface of the upland varies from gently rolling in the Cariboo and Chilcotin districts of the north to hilly and even mountainous in the south. Much of the upland, particularly in the northern districts, is poorly drained with marshes and ill-defined stream courses issuing into ponds and lakes occupying swales in ground moraine. Meadows exist in great numbers. These are of the utmost importance as sources of wild hay throughout the Cariboo and Chilcotin districts although in the south where they are fewer in number dependence on cultivated hay is much more general.

Not only has topography been significant in accounting for the kind of hay produced and methods used; it also bears directly on variations in local climates. These in turn are reflected in the types of native vegetation used as forage. In the deep valleys throughout the plateau where elevations range from 1,000 to 2,500 feet the climate is semi-arid conforming to Köppen's steppe type (BS) (Fig. 4). Aridity is reflected in xerophytic shrubs, such as sage brush (*Artemesia tridentata*) and rabbit bush and in several varieties of bunchgrasses, the climax type being bluebunch wheatgrass (*Agropyron inerme*). Precipitation is light varying from 7 to 11 inches. July average temperatures approach the seventies. Foehn winds, called locally chinooks, help to keep the low-lying valley bottoms clear of snow through much of the winter thus providing meagre amounts of winter range. At elevations of 2,800 to 3,200 feet varying with exposure and edaphic factors, open grassland gives way to light timber stands, with such species as fir, aspen, and lodgepole pine predominant. Yellow pine makes its appearance at lower levels in the southern part of the plateau. Vegetation changes reflect the transition from steppe to Köppen's Dfb and, on the higher surfaces, Dfc climates. The frost-free period varies from one to two months over most of the uplands and precipitation increases from 12 inches to 20 inches along the higher eastern margins.

The uplands serve as summer range where the cattle graze on pine grass (*Calamagrostis rubescens*), vetches, forbes, and sedges. Such succulent feed wilts with the first killing frost of September and becomes unpalatable, thereby forcing the herds to seek the "hard" grasses, below the timber. Seasonal changes induce the familiar movement known as transhumance particularly in the rugged southern part of the plateau.

VARIATIONS IN THE WINTER FEEDING PERIOD

Variations in the winter feeding period are indicated in Figure 2. Data were obtained from sampling over 100 widely distributed holdings throughout the area. Resulting numerical values used to draw the isarithms are the subjective estimates of the individual ranchers and not averages of carefully recorded statistics over a long period of time since such information is not available. However, for the scale of the map used, the reliability may be considered good. Data refer to most of the herd, but do not include calves and weak stock.

The isopleths reveal a pattern conforming closely to the physical factors men-

tioned above. Thus along deep valleys where the climate is semi-arid and snows are of short duration feeding may be necessary for a period of from less than one to as much as three months on the average. Such valleys as the Thompson, the Nicola, and Princeton basins and also the middle course of the deeply-entranched Fraser River and that of the lower Chilcotin fall within these limits. Along the shallow stream courses of the uplands, such as the San Jose and upper Bonaparte Rivers, the feeding period is from three to four months long. Away from the valleys the period exceeds four months reaching as much as six months along the eastern margin where snows of winter are deep and prolonged.

In order to shorten the winter feeding period, ranch units attempt to procure, where possible, land at lower elevations, for here are concentrated the choice spring, fall, and winter range as well as the most desirable sites for cultivating hay. Those units removed from the major valleys and depressions are generally small, marginal operations with a feeding period of four to six months.

Although the physical factors are of major importance in accounting for differences in the feeding period, ranching practices also play a part. These vary with districts and with the attitude of the individual rancher toward range conservation. In remote districts of the Chilcotin and Cariboo many ranchers are accustomed to turning their cattle into spring range even before the first flush of new grass has appeared thereby reducing the feeding period contrary to good range use.

In the districts to the south greater areas of bunchgrass for spring and fall range tend to shorten the feeding period. However, the custom here is generally to conserve such range and feed longer. Ranchers are coming to appreciate that a slightly longer feeding period will bring two-year old steers to prime condition in a shorter time after being turned out in the spring.

WINTER DURATION INDEX

In order to obtain objectively a method of comparing variations in the winter feeding period from place to place a winter duration index has been devised. While this index has no quantitative value it does serve to indicate the relative duration of winter conditions over extensive areas. Since it rests on readily available weather data it has a wide application.

Within certain limits cattle are fed in most districts during the time snow remains on the ground.[4] Therefore, a measure of the duration of snow serves as a fairly close indicator of the winter feeding period. While statistics are not available in this area for the duration of snow, information regarding the depth of snow for 29 stations is shown in Figure 5. A general pattern may be observed in which the higher margins of the plateau, especially along the east, receive from 46 to 100 inches annually, the upland surfaces receive intermediate amounts of 35 to 45 inches, and the lowlands receive from 14 to 34 inches. In the latter category the evaporation rate is highest so that patches of ground are bare for much of the winter.

[4] Cattle can rustle for forage under a light snow cover of several inches providing a crust does not form. Winter rustling is not long continued in this region except in the deep valleys where frequent thaws occasioned by chinook winds leave the ground bare or nearly so.

Temperature must also be considered as a factor in the index since a relatively light snow may remain well into the spring should average daily temperatures remain low, while a larger amount disappears quickly where average temperatures remain above freezing. The former condition is typical of the uplands while the valleys, even along the eastern margin, clear relatively early.

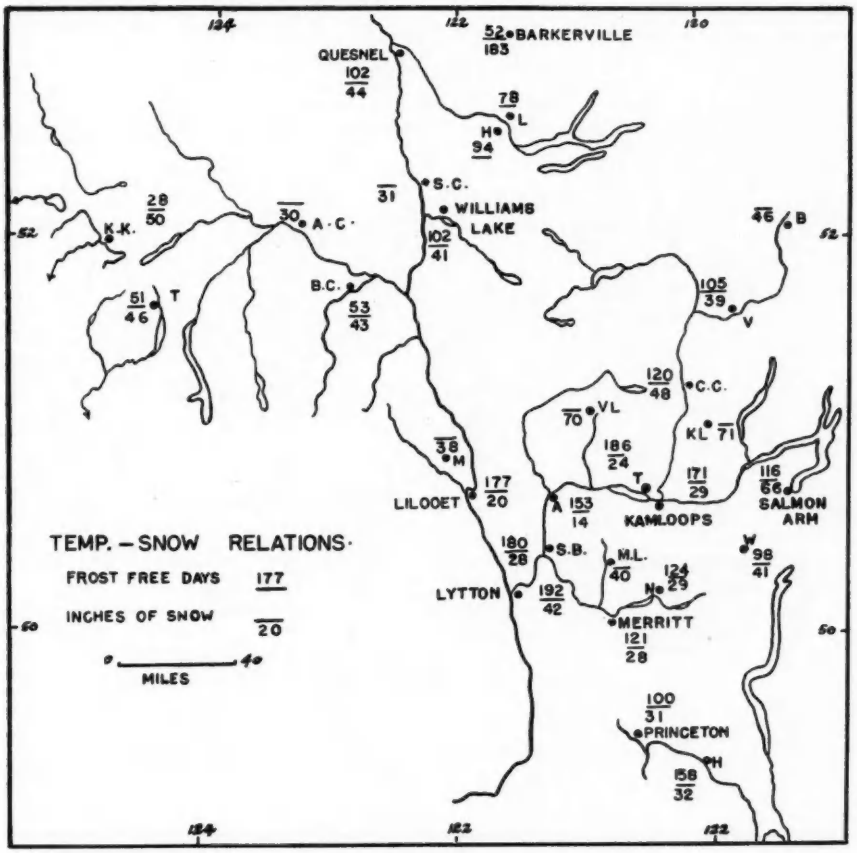

FIG. 5.

By correlating the temperature factor (F), using frost-free days as the complement of the freezing period, with depth of snow (S) in inches in the expression

$$WD = \frac{10F}{S}$$

a winter duration index (WD) is obtained. The smaller the index the more prolonged are winter conditions. Indices ranging from 5 to 30 indicate a feeding

period of three to six months, those from 60 to 100 represent conditions favorable to a short feeding period of a month or less, and those from 30 to 60, from one to three months.

While the resulting index has no quantitative value, it correlates closely with the feeding period estimates provided by ranchers (compare Figs. 5 and 6 with Fig. 2). Thus remote districts of the upland with long, severe winters have indices

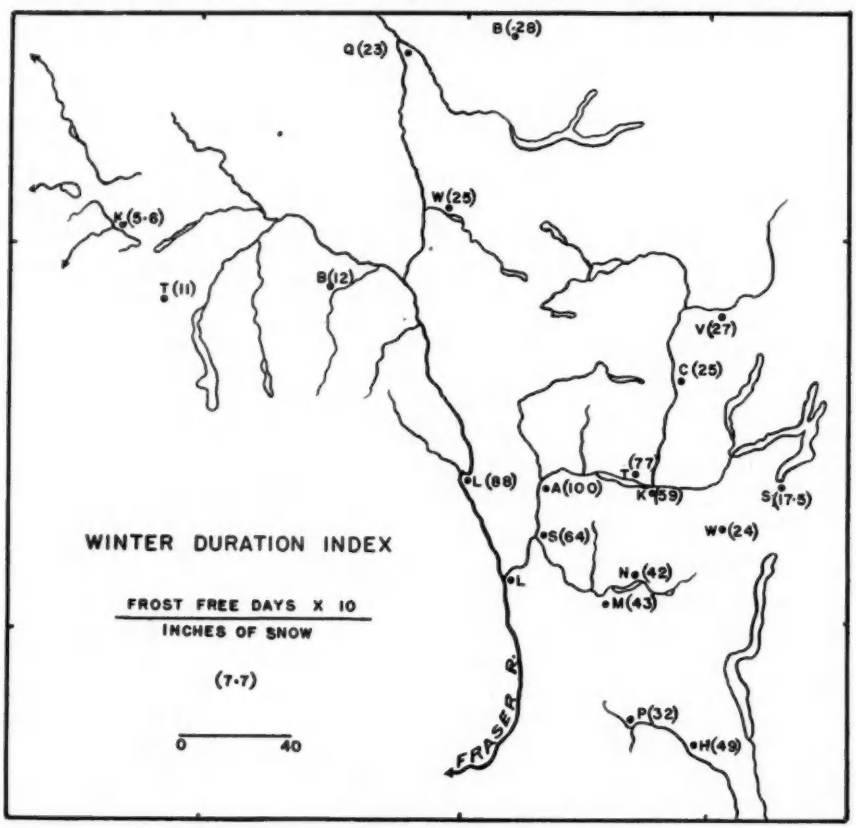

FIG. 6.

ranging from 5 to 12 while valley locations have indices of 70 to 100. Along the eastern margin, owing to large amounts of snow, the feeding period is relatively long in spite of a comparativelay short frost season. This is well illustrated in the case of Salmon Arm on Shuswap Lake where ranching gives way to mixed farming.

Only in the remote Chilcotin is there some disparity between the index and the length of the winter feeding period. Here, the large number of wild meadows with

tall sedges and willow shrubs permit cattle to rustle as late as January beneath a cover of 6 to 8 inches of snow.

In Figure 7 the variables "inches of snow" and "frost-free days" used in the winter duration index have been graphed for 19 stations. Three major clusters appear: the first having a long frost period and heavy snow; the second having somewhat more moderate conditions; and the third cluster enjoying mild winters with little or no feeding needed. The graphic method may prove useful in compar-

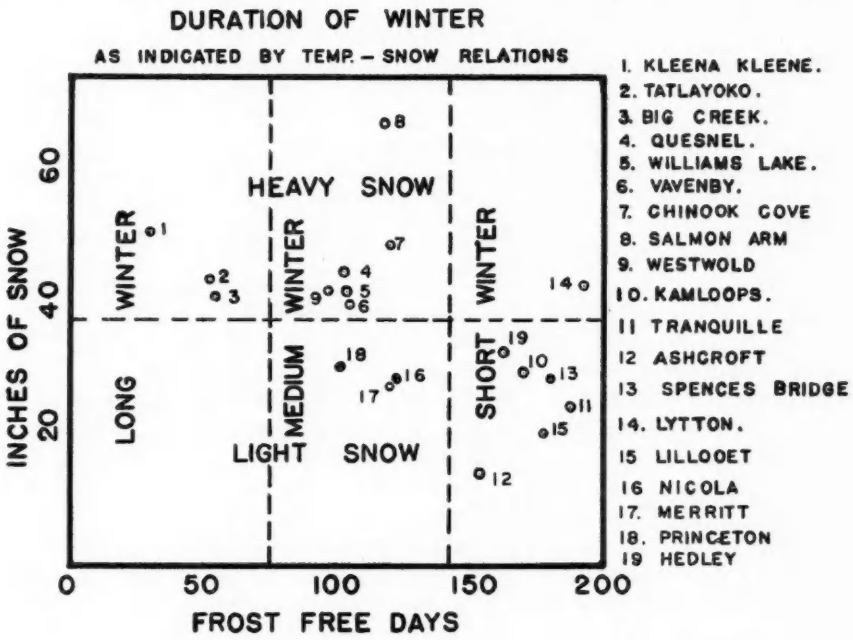

FIG. 7.

ing other ranching areas with similar climatic conditions such as the northern Great Plains.

SUMMARY

The winter feeding period within the southern Interior Plateau of British Columbia varies from zero in the deep valley bottoms and lower terraces to six months along the high eastern margin flanked by the Cariboo and Monashee Ranges. On the uplands the minimum feeding period is seldom less than three months. Dependence on wild hay, chiefly sedges and horsetail, is common although ranchers are coming to appreciate the superiority of cultivated hays, especially timothy and alfalfa. In the lowlands below 3,000 feet where the open range affords conditions favorable to early spring and late fall grazing, the feeding period does not exceed

three months and is frequently less. Here dependence on cultivated hays is nearly complete. Only those ranches which have been fortunate enough to acquire land along the lower terraces and bottoms of major valleys can rustle some of their cattle all winter. In keeping with good range practices, dependence on winter range is giving way to supplementary feeding for part of the winter.

Accepted April 1953

ABSTRACTS OF PAPERS PRESENTED AT THE 50TH ANNIVERSARY MEETING OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS, HELD AT PHILADELPHIA, PENNSYLVANIA, APRIL 11, 12, 13, 14, 15, 1954

MAMIE L. ANDERZHON—*Attitude of Children Towards Maps*

Cartographers assist in the designing of both general and special purpose maps produced for an annual elementary school enrollment of more than 25,000,000 boys and girls. What are some of the attitudes towards maps of these consumers and users of maps at the elementary level? The statements here made are based upon observations, experiences, unsolicited comments, and answers to questionnaires from approximately 750 children in grades below nine, during the past six years. They should not be interpreted as conclusive for much more research is needed in this area.

According to the data many six and seven year old children are curious about maps. However, it is at the ages of nine or ten years that about 65 per cent of the children use maps and globes as a "pointer device" for locating places and tracing trips or routes of trips, either real or imaginary. Forty-three per cent of the children report that road maps are the first maps they recall using and handling. This experience was usually outside the class room. Another 30 per cent of the children report their first interest in maps grew out of seeing and handling the physical-political globe and using the wall maps of the United States and the world in the 4th grade classroom. Although less than 10 per cent of the children had the following experience, their interest in maps began in the second grade when they selected landscape features in their local neighborhood, made three-dimensional symbols of their home, school, etc., and arranged them on a large scale map that had been made by the teacher. From this experience these children improved their sense of direction and acquired more of a concrete concept of distance.

Nine- and ten-year old children seem more interested in maps that tell them where places are located, especially with relation to how far a place is from where they live. They can visualize semi-pictorial symbols and have begun to reason the "why" for their observations. At this age curiosity regarding wall maps, road maps, and globes seems to outweigh an interest in putting ideas on an outline or base map.

Upper grade and junior high school pupils frequently request outline maps for showing a single idea or relationship. At this age they show initiative in experimenting not only with copying ideas, but showing relationships they feel can be expressed best on a map. This age level is still struggling with scale and requires many concrete experiences with distances in miles and hours, and areas in square miles in the real landscape, in order to pull into focus large areas on a map they can use. For this age maps are sources of information about location, direction,

distance, patterns of arrangement and distribution, relationships between people, and man's activities on the earth. For this age maps also become instruments that raise questions about people and landscape.

Five years ago the junior high school pupils in my classes requested that each one have a copy of Raisz's *Physiographic Map of the United States.* When asked why they wanted the map some of their replies were:

> "The map gives me a better idea of how the land really looks in many different places. It tells me more about the top of the earth." "I need one of these maps for trips. I can watch for and locate the features shown on the map in the real landcsape."

For what purposes do junior high school boys and girls use maps? About 90 per cent use maps for showing locations and relationships of man's activities to the natural features. They sometimes call it making the map tell a story better than they can say it with words. About 20 per cent use maps for planning and following routes of trips. Over half of the pupils have reported they like to study maps as a recreation.

As junior high school pupils often say, "With enough maps and pictures I can almost visit any place on the earth."

S. WHITTEMORE BOGGS—*Global Relations of the United States*

Within the last sixty years the external relations of the United States have assumed truly global proportions—in economics, international politics, and cultural relations. One of the serious roadblocks to understanding these relations is flat-map thinking derived from the use of Mercator and other world maps. But the world is round any way you look at it. A few hemispheres that contain the entire United States will be shown, which have first been studied on a globe with transparent overlays.

There is no human being who does not live in some hemisphere that includes the entire United States, and the peoples of every "cultured world" are geographically much nearer to us than most of us realize.

The roundness of the earth is very real in human relations. The currents of air and all other world weather phenomena, the ocean currents, man's routes of travel by air and sea, and his telecommunications patterns, all bear the stamp of the earth's sphericity. Eventually probably even the patterns of man's political institutions will bear the unmistakable imprint of the global relations of all mankind.

Many technical difficulties must be overcome before we can readily visualize geographical relationships that can be perceived only on globes. The writer's most useful present unofficial responsibility, in his own estimation, is serving as chairman of the National Research Council's "Committee on Construction and Use of Precise Globes and Spherical Maps" which is working on a comprehensive long-range program. Within individual nations there are also serious roadblocks to an understanding of world relationships. There is widespread fear and dis-

trust of foreign peoples, in deeds and products—which might be called "phobiocracy."

Perhaps if the earth were as large as Jupiter we could protest that it is too much for human beings to comprehend world-wide relationships. But beginning at an early age we need to introduce each generation to concepts of the world as a whole, to its "wholeness-properties," and to the fact that the whole is more than the sum of all its parts. When children begin early to see and think in world terms, realistically related to the roundness of the earth, the solution of world problems will become tractable.

JAN O. M. BROEK—*Friedrich Ratzel in Retrospect*

The semi-centennial of Ratzel's death (1904) is an appropriate moment for a reappraisal of his work. The notion that he was merely an environmental determinist is incorrect. Nevertheless, this view has been so generally accepted that few geographers nowadays bother to consult Ratzel's works. Many of his fruitful ideas are ignored or ascribed to other writers. Now that American Geography has passed through the virulent anti-environmental phase it is time to evaluate Friedrich Ratzel's stimulating contributions anew. Several of these are briefly discussed in this paper, such as: Ratzel's opposition to the rationalistic concept of Man; his recognition of the role of culture and culture diffusion; his analysis of population and population movements; his emphasis on circulation (*Verkehr*) and location (*Lage*), especially for understanding the functioning of areas; his efforts to bridge the gap between Geography, as a "science," and the humanities; his contributions to the history of Geography; his influence on other social sciences; and his attempts to formulate "laws" of human behavior. Appreciation and depreciation of Ratzel is related to the changing intellectual currents of the last fifty years.

WESLEY CALEF—*Integration of the Use of Irrigated and Non-Irrigated Land in the Intermont West*

Because irrigated lands are the golden acres of intermountain agriculture there is a tendency to forget that they make up only a minuscle portion of the total land area of the intermountain West. In only one state does irrigated land embrace more than 5 per cent of the total land area, and in eight of the intermountain states irrigated land occupies less than 2½ per cent of the total land area.

The major characteristics of irrigated land and dry land from the standpoint of agricultural production are considered. Although in some of the larger irrigated areas of the West specialized irrigation farming is not only practicable, but necessary and profitable, it is also true that over most of the intermountain region integration in the use of irrigated lands and range lands is highly desirable and in many places almost inescapable. The advantages of integration are shown to be economic advantages.

Since integration is economically highly advantageous, why then is there any problem of integration? The problems of agricultural integration of the utilization

of irrigated and non-irrigated lands arise from the multiplicity of ownerships (private, county, state, and national) of the dry lands, from the extraordinarily complex areal pattern of land ownership, from the difficulties of obtaining land-use co-operation among the various agricultural users of the land, and from political conflicts among the various interested parties as to the proper methods of land holding and use of the dry lands.

Although the advantages derived from integration are economic, the problem is shown to have important social, cultural, and economic aspects.

ALAN S. GARDNER—*Application of Geography in Marketing Research*

With current business and economic conditions adjusting themselves downwards from their peak war-time levels and with a return to somewhat normal competitive environment, market and industrial research has become increasingly important and has attained new status in industrial and retail organizations. Data on problems of marketing, whether they entail new product development, present product penetration, regional analysis of sales, or market prediction and forecasting, and whether they involve the disciplines of economics, geography, statistics, or engineering are all being collected and assembled, analyzed and correlated for use to management in high level decisions.

The geographer who is interested in the application of his academic training is able to contribute a variety of unique opinions and concepts to the various levels of marketing research activity. Many of the problems of day to day business research center around geography as such and actually include the fundamentals and the theories of physical and economic geography. For example, because of the wide differences in industrial locations and regional groupings it is usually revealing to break down all facts of any one market assembled in a qualitative analysis on the basis of regionalism. This is certainly true of such markets as metal and wood furniture, irrigation pipe and fittings, or the aircraft industry. Another important contribution a geographer is qualified to make is the evaluation of distribution problems between raw materials, manufactured commodities, and the ultimate consumers. This factor is particularly important in the aluminum industry where consumer markets are often distantly located from the fabricating or primary supply sources. Also, a geographer with an academic appreciation of geographic limits or boundaries is highly qualified to organize an effective sales district on a regional scale that will maximize all sales effort within that region. Such principles are also important in the location of secondary channels of distribution, such as warehouses and distributors.

This paper presents an example of a market report for irrigation tubing as an application of geographic method to business through market research.

ARCH C. GERLACH—*The Public Attitude in the United States Toward Maps*

The attitude of the American public toward maps is not homogeneous. On the basis of records in the Library of Congress Map Division since its establishment

in 1897, of reports by the Map Use Committee of the American Congress on Surveying and Mapping, and of personal observation of fellow countrymen from coast to coast, it does seem possible to discern a pattern in the public attitude toward maps.

The largest component of this pattern is a dull background of indifference and ignorance concerning the existence, sources, or uses of maps; and inability to read or interpret accurately the maps that do get attention.

In sharp contrast are a few small, bright spots representing professional groups that enthusiastically promote maps as the fundamental basis for national security, economic planning, and all sorts of special uses by geologists, engineers, historians, weather analysts, marketing experts, political scientists, etc. There are, however, too few salesman on these islands of research and scholarly development to bridge the background of ignorance and indifference between cartographers and the scholars of other disciplines.

Another component of the public attitude pattern, however, is that of groups with sharply limited map interests, based upon specialized use even to the exclusion and ridicule of maps designed for other purposes. Among these are some admirers of historical cartography as the epitome of artistic cartographic expression; some engineers who feel that cadastral and topographic surveys result in the only true maps; and a recent group of curved map advocates who regard with dismay projections upon a plane surface.

Finally there is the gullible attitude of many people that all maps are accurate and that facts presented on maps are especially authentic. This is an inviting market for propaganda maps conveying political, social, and sales concepts, and for the educator to combat the misconceptions inadvertently gained through public ignorance of map interpretation.

CLARENCE J. GLACKEN—*The Idea of Progress and the Habitable World*

The belief in continuous and inevitable progress has been one of the most significant ideas of modern Western thought. This belief was widely accepted by many thinkers from the early eighteenth to the early twentieth century. The idea became a binding force incorporating many subsidiary ideas which were often contradictory or mutually exclusive. The relation of the idea of progress to questions that were raised concerning population growth, the history of settlement, and the ability of mankind to maintain the habitability of the world are of particular interest to this discussion.

The belief in progress obscured the real nature of many of these relationships. They were considered less in their own right, more as elements of a progressive societal evolution. These difficulties can be seen in the writings of political and social theorists, such as Malthus, John Stuart Mill, H. C. Carey, and Herbert Spencer, and of geographers, like Elisée Rechus, Ernst Friedrich, and Friedrich Ratzel.

Widespread acceptance of a belief in inevitable progress declined during the period of the First World War. Two ideas, also with long histories, have now

come into prominence: 1) an optimism, which seems to have replaced the idea of progress, based on faith in science; and 2) a pessimism derived in large part from an emphasis on the limitations of the environment, unfavorable ecological changes of nature, and the resistance to cultural change.

These two approaches have different historical origins. Current disputes between optimists and pessimists are a reflection, at least in part, of differences in emphasis determined by these two divergent ideas. This situation has prevented a synthesis from which discussion and research could proceed.

The history of ideas can provide some clarification of the reasons for these differences by pointing to the assumptions and the subject matter upon which each idea is based. But, more importantly, the decline in inevitable progress, the rejection of teleologies, laws, and various determinisms have cleared the way for considering many questions, such as technological advance, resource use and depletion, population growth, and ecological disturbances, in their own right. The result could be a narrowing of the range of controversy and the creation of a mutually acceptable point of departure for the study of these problems.

EDWIN H. HAMMOND—*An Objective Approach to the Description of Terrain*

In an attempt to gather, develop, and test methods for the areal description of terrain with emphasis upon objectivity, comparability, and practicability, one fundamental question has been: what are the units or individuals that are actually to be described, compared, and grouped? If terrain is to be considered in terms of fair-sized assemblages of slopes, unit areas must be large enough to allow important attributes of such assemblages to become evident and definable. Individual features and "homogeneous areas" are less justifiable units than are arbitrary geometrically bounded areas a few miles across.

A second basic question is: what are the specific characteristics or elements which, through their variation, make these units different from one another? Comparison of many samples yields a long list of attributes, which can be grouped under the headings of 1) slope, 2) composition, 3) arrangement, and 4) dimensions. The complete list can serve as a guide for descriptions and as a basis for a thorough natural classification from which categories may be selected for any desired purpose. For the sake of simplicity and in order to permit the identification of recurring terrain types at a fairly high level of generalization, a shorter list may be selected containing characteristics that seem particularly diagnostic and relatively easy to obtain and express.

The state of Missouri is being used as a trial area for the testing of the practicality and practicability of the above concepts. Contour maps, aerial photographs, and field reconnaissance are all being tried as sources for specific terrain information, with varying degrees of success.

Work thus far indicates that objective, comparative terrain description is both possible and practicable. The careful, sometimes quantitative study of landform elements, which has been applied in the past to certain aspects of slope and relief, can and should be extended over the whole complex list of characteristics.

F. KENNETH HARE—*Synoptic and Dynamic Climatology: some notes on Methodology*

Dynamic climatology was defined by Bergeron in 1929; he regarded it as the study of world climates in terms of the general atmospheric circulation. The latter was to be resolved into flow-types analogous to the monsoons of the east, and these were in turn to be resolved into frequencies and sequences. Air masses and fronts, the Norwegian tools of synoptic analysis, were the sufficient and necessary means of doing this. Bergeron's lead gave rise to many studies of airmass climatology; Borchert's recent study of the general circulation seems its logical conclusion.

Synoptic climatology was a creation of wartime needs for statistics of weather elements analysed by circulation type. It is clearly related to dynamic climatology, though more limited and precise in scope.

The limitations of airmass climatology and the use of streamline or mean pressure charts render desirable some alternative base for operations. Point and/or areal frequencies of airmasses, frontal passages, cyclones etc., offer one means of basing the analysis on daily chart series. The statistical representation of the pressure pattern, as developed by Wadsworth, is now being used as an objective basis for a dynamic climatology of North America. The work of many of the extended forecast groups is regarded as being climatological in nature.

CHAUNCY D. HARRIS—*The Last Fifty Years and the Next*

The Fiftieth Anniversary of the Association provides an occasion to survey changes in the American economy during the last half century. In this period the total population doubled and the urban population trebled. The automobile caused major modifications in the layout of cities.

New patterns evolved in fuel production and in transportation. The proportion of total inanimate energy derived from coal dropped from 90 to 40 per cent; that from petroleum and natural gas rose from 8 to 57 per cent; the center of fuel production shifted from Pennsylvania to Texas. Railroads dominated domestic transportation at the beginning of the period, but the rise of passenger cars, trucks, buses, improved highways, airplanes, and pipelines soon added diversity to transport facilities.

Although the agricultural labor force declined about 35 per cent and the amount of cultivated land increased 17 per cent, effective agricultural production about doubled. Tractors replaced horses and the use of fertilizer multiplied eightfold.

The number employed in manufacturing trebled and the production per worker doubled. New industrial giants appeared in the automobile, tractor, aircraft, radio and TV, household appliance, and chemical industries.

These are changes in the last half century. What are the prospects for changes of a similar magnitude in the next fifty years?

FRASER HART AND EUGENE MATHER—*Southern Agriculture: Thirty Years of Progress in the Last Half Century*

Characteristic features of Southern agriculture are illustrated by maps, graphs, and Kodachrome slides.

Emotional provincialism characterizes many analyses of the South. The Southern enthusiast, who views the South in historical perspective, sees great advances which have been made in the last half century. The Northerner emphasizes the fact that the South still lags behind the rest of the nation. The Southerner buttresses his arguments with time comparisons; the Northerner, with comparisons based on area. Objective consideration of both viewpoints reveals that the South is making progress, but that it still lags behind the nation. The progress of agriculture in the modern South is still hindered by lack of capital, which has been a major problem since the Civil War.

The capital deficiency of Southern agriculture is largely a product of Southern culture. The combined effects of three factors, none of which would have proven a major obstacle by itself, have effectively inhibited capital accumulation. *First,* much Southern income is expended on gracious living and display, little on productive expansion. *Second,* although a large share of Southern income goes for education, the total amount invested per pupil is low in a low income region; the provision of "separate, but equal" facilities is an additional financial burden. *Third,* capital accumulation has been hindered by such specific Southern agricultural practices as:

1) Shifting cultivation. This is a response to the severe deterioration of leached soils which have been cropped for a number of years.

2) Cash cropping. Continued experimentation with a series of cash crops, of which cotton is best known, has hindered capital accumulation; in addition, cash cropping has provided a less dependable source of income than would have been produced by diversified agriculture.

3) Extensive use of mineral fertilizers. The absence of animal manures which a mixed farming system would have produced has necessitated greater expenditures for mineral fertilizers.

4) Diversification without integration. Diversification has resulted from the co-existence of various specialty farms, which often waste or discard products of value to adjacent farms; these products would be conserved and used if the farm had an integrated concept of management.

The capital deficiency of the South has been ameliorated considerably since 1933. The beneficial effects of federal subsidies to agriculture have been largely counterbalanced by their perpetuation of poor farming techniques and outmoded crops. Industrialization has indirectly benefited Southern agriculture by putting money in Southern pockets and thus expanding the regional market; moreover, the prestige value of land ownership is still strong in the modern South, and city dwellers have financed many agricultural improvements.

With increasing availability of capital, the South may now be able to capitalize on her great potentialities by improving cropping practices, reclaiming poorly drained land, utilizing idle land, and using land freed as horses and mules are replaced. The greatest future possibilities for the South, however, seem to lie in multiple cropping.

RICHARD HARTSHORNE—*Kant, Humboldt, and Hettner on the Place of Geography among the Sciences—An Attempt to Trace the History of an Idea*

In a basic essay on the methodology of geography published in 1905, Hettner presented a logical theory of the position of geography among the sciences which became widely accepted in Germany and was more recently introduced in this country. All empirical knowledge may be studied in terms of 1) particular categories of phenomena wherever or whenever found—the systematic sciences, including botany, zoology, or mineralology; 2) significantly related differences of all interrelated phenomena in successive periods of time—the historical or chronological sciences, of which what is commonly called history is one; and 3) significantly related differences of all interrelated phenomena in the various section of space—the cosmographic or chorological sciences, including astronomy and geography. What were the sources or antecedents of Hettner's statement of his theory?

We know that essentially the same concept had been stated over a century earlier by two scholars of high rank in scientific thought. The philosopher Kant had presented the concept in his lecture course in geography as early as 1775, which was published in 1801–2. Humboldt had stated it in different terms in methodological passages or footnotes included in several substantive studies, first in 1793, and more fully in the introduction to the *Kosmos,* in 1845—but in the latter case in respect to a wider field than geography.

The course of development of science, and of geography in particular, in the second half of the nineteenth century led to total eclipse of these views. We may accept Hettner's statement that he was ignorant of Kant's views and at least not consciously aware of the similarity of Humboldt's views to his own. It seems probable, however, that Humboldt's ideas had entered into his thinking, either directly from his own readings in Humboldt or indirectly through Richthofen, before he endeavored to formulate his methodology.

Humboldt's statement of 1793 shows no similarity in form or terminology with what we know of Kant's statements, though the two are consistent in substance. There would have been numerous chances for him to see hand-written copies of Kant's lectures or to have received his basic concept concerning geography from one or more of Kant's students, but we have no evidence that either occured. If he arrived at his own basic concept independent of Kant, it is certain that he later studied Kant's published statement and used that in restating his own, but with sufficient differences so that we cannot properly say, "Humboldt followed Kant."

A part of the total theory, which is perhaps of greatest significance, the view of geography and history as similar in character, his been recognized on a purely empirical basis much more widely and from an earlier time. It was explicitly stated at least as early as 1747 by the geographer Franz. It is entirely possible that his writings may have been known to either Humboldt or Kant or both, but I have found no evidence for that or for earlier statements of this direct comparison, which however may well exist.

RICHARD HARTSHORNE—*The Geography of the Balance of Power*

The concept of the balance of power in the international field is dependent not merely on the theoretical nature of the state system, but more specifically on the actual geographic pattern of states in the power theater. One major consequence is that the number of states that could possibly increase in power to such a point as to dominate any actual power theater is seldom greater than two or three, but can never be assumed to be less than two. Hence, it is in the common interest of all other states to construct a system of power relationships sufficiently flexible to maintain constantly an approximate balance of power between each of the contending threats so that none can secure overall domination.

The necessity for flexibility requires that one or more states be free to change the amount and direction of their support. The ability of any state to assume the role of "the balancer," more properly, the leader in balancing power, depends on a number of qualifications, certain of which are dependent on its geographic location in relation to all other areas in the theater of power.

Only a few generalizations may be established deductively from the qualifications listed. Location on the periphery of the arena provides much greater security than a central location, but may hamper effective utilization of power. A maritime location partakes of both the advantages and disadvantages of a central location so far as sea power is concerned. Beyond such broad generalizations, the complexity of the factor of relative location forces use of the case method, applying the several qualifications to particular states.

Examination of the situation of half a dozen European states leads to the conclusion that in that theater only Great Britain occupied a position that enabled it to function over centuries as the leader in the balance of power. Changes in the power pattern on the continent in the 19th century deprived Great Britain of the freedom of action necessary to the role of the balancer.

Simultaneously extra-European states entered the arena of power. From as early as the 17th century the theater of action among European states had expanded to include the entire North Atlantic quarter-sphere and, in much lesser degree, the more remote portions of the world. During much of the 19th century a major segment of the North Atlantic area had been largely neutralized by the policy of unarmed aloofness of the potential power of the United States. But in constructing major naval power just at the time the power relationship in Europe was becoming increasingly unbalanced, the United States in effect re-entered the North Atlantic arena, in a geographically favorable position from which to act as the balancer of power in Europe. At the same time however it was involved, together with Britain, in the lesser and more remote arena of the Western Pacific, where the rise of imperial Japan had created a far greater imbalance. While the power struggle had thus become a world phenomenon, in major degree it remained and still remains concentrated in the North Atlantic quarter-sphere, to which all other parts of the world are supplementary.

EDWARD HIGBEE—*The Old Frontier: Pioneer Remnants and Recent Trends in Eastern Mountain Agriculture*

During the past 25 years changes made in land improvement methods and in farming techniques have been paralled by reappraisals of land values. Some places previously considered wastelands are now being shown to have fine agricultural prospects. In contrast much of the Appalachian-Ozark uplands, once cleared for small scale commercial and subsistence farming, is being abandoned. This Appalachian-Ozark country is called the Old Frontier for historical reasons and because pioneer methods of husbandry still survive to some extent.

The trend away from farming which was particularly pronounced in New England during the past century is continuing throughout the mountainous portion of the eastern United States. However, there are major differences between what is happening in the 20th century as compared with New England's 19th century experience.

Because he has an automobile and hard-top roads, the modern mountaineer, who decides to earn his living in town rather than on the land, generally keeps his farm as a residence. He often continues part-time farming activity to supplement his city wages. Making room for the 40 hour week at the shop and office calls for conversions to types of husbandry requiring less labor time.

In the North among this class of farmer there is a perceptible trend toward more mechanized cash cropping and away from dairying. In the South the trend is away from labor-demanding cotton into cattle, especially beef stock. The 9 to 12 month southern pasture season greatly reduces labor demands compared with those involved in northern dairy husbandry or southern cash-cotton culture. Farm incomes are somewhat reduced but, because of better paying urban employment, total earnings are increased.

In the future we may witness two general trends in the southern portion of the Old Frontier. One will be an increase in the size of full time farms with more livestock and more special legume-grass pastures. Another will be a steady decline in subsistence farming with more and more of the small scale commercial operators going out of business entirely or at least reducing cotton in favor of a few cattle and a job in town. In the northern portion of the Old Frontier the trend will be away from class B dairying into specialized class A dairying or into cash crops on the better farms. On the undersized or poor-soil properties of men with little capital there will be limited cash cropping, land-renting to neighboring units, and outright abandonment of everything except the house. With the exception of increased cash cropping in the north, which is destructive to soil resources, these are healthy changes. They reflect man's increasing value as a worker.

In the meantime, whatever land is abandoned now will be preserved under woods, brush, and grass until the day when a more populous America will offer the man with poor land such a handsome price for his crops and animal products, he will find it worthwhile to go back to the plow.

JOHN C. HOFER—*Applied Geography in the Field of Commercial Map Publishing*

One of the most obvious opportunities for the application of geography is in the field of commercial cartography. Since few people with geographic interests desire to or are trained to do all phases of the tedious compilation, drafting, and checking required to complete a full color commercial map, most geographers working in the field have assumed specialized functions and responsibilities. The purpose of this paper is to exemplify the role of the geographer employed in commercial map publishing by tracing the steps in producing a school wall map and pointing out some of the unique contributions of persons with geographic training.

The geographer's contributions toward solving problems of cartographic production may be summarized into several categories. Familiarity with cartobibliographic aids is a unique contribution of great value. A concern with the study of areas and the totality of activities within a given area aid in preliminary planning and selection of content to be shown on a given map. Geographic talents are especially valuable in making compilations of small scale maps with the necessary selection and generalization of data. Perhaps the most valuable asset is the geographer's knowledge of how maps are used in research and teaching.

GEORGE W. HOFFMAN—*A Changing Cultural Landscape in the Middle Upper Inn Valley (Tyrlo, Austria)*

The region between Stams and the Oetztaler Ache, in the middle upper Inn Valley, 22 to 30 miles west of Innsbruck, is located between heights on the west which run diagonal to the Inn trench and steep slopes of mountains on the south and north. The effects of the Foehn are especially strong here. The area is representative of the dry, warm, and bright interior Alpine valleys. The productive capacity of the soil is largely determined by the water supply, and the available water has been distributed by irrigation canals since shortly after this region was settled.

This region is close to a line crossing the Inn trench between Silz and Roppen, which divides the upper Inn Valley itself and determines not only the distribution of the closed farms, but also other cultural traits. East of this line, German roots in the names of settlements are more numerous as compared with the Illyric and Rhaeto-Romantic names west of this line. The districts of Silz and Imst form a marked contrast. Differences in house types and in the physical characteristics of the people become noticeable here; more of the pre-German characteristics are present west of the line. The original settlers of this area, Rhaeto-Romantic people, preferred settlement in *Haufendoerfern;* widely scattered single farmhouses so typical for other Alpine parts, were relatively few here. As a result of agglomerated settlements, distant fields have become normal. To this must be added the Roman law interpretation with relation to the partitioning of land and soil, the complete material partitioning of farms, houses, and forests.

As a result of constant subdividing, the 2660 acres of farming area in the region investigated belonged to 596 owners in 1948, prior to redistribution according to a new plan. But the truly extraordinary thing is that a large majority of the farmers

had as many as 30 different pieces of land, some at a distance of more than three miles from others.

This study discusses the changes brought about since the beginning of the 16th century; the reasons for the deterioration of the agricultural position of these communities, and the effect of the introduction of maize—quite common by 1625—and of potatoes—200 years later—upon agricultural practices. How the evergrowing surplus population emigrated to various parts of west and southern Germany and also sought employment in ever increasing numbers in the urban centers is cited. The building of railroads brought about cheaper importation of cereals and had an important bearing on the reduction of cereal acreage, especially that of maize. This produced a shift from cereal production to grazing and animal husbandry, but, as a result, the farmer became less self-sufficient.

Finally, repeated droughts, the cry for water, and the possibility of obtaining outside financial aid for a common project made it possible between 1947 and 1951 to change the cultural landscape completely. Considering the problems of the whole region, a plan was laid out and executed by which a new system of irrigation canals with greatly increased water supply brought new land under cultivation or intensified present irrigation practices; combined properties by relieving existing built-up areas; adding land and building new homes. In this way the serious problem of partitioned homes was successfully attacked. New roads were laid out and the settlement of small industries, employing surplus agricultural workers, was encouraged.

After constant deterioration for nearly 500 years the Stams-Oetztaler Ache region today is one of the most progressive and advanced farm communities in the Alps. Modern technology and an awareness of joint responsibilities have contributed toward changing the cultural landscape of the middle upper Inn Valley.

HOMER HOYT—*Development of the Economic Base Concept*

The economic base concept developed as a working tool for estimating the future growth of employment and population in specific American cities. Instead of analyzing every type of employment, the problem was simplified by concentrating upon basic employment which controlled all the rest. Basic employment was defined as those types of employment which produce goods or services for people living outside the urban region and which bring in money to pay for the food, raw materials, and manufactured goods which the urban region itself does not produce. Service employment consists of jobs in retail trade, the professions, local government, local transportation and utilities, construction, and domestic service which is required by the basic workers.

In the early studies in 1936 on the economic base, it was assumed that one service worker was required for every basic worker. In later studies in 1944, more accurate measurements of basic employment showed that the ratio of basic to service worker varied between different cities from 1 to 0.6 to 1 to 2.1.

The most thorough analysis of the number of basic workers in different categories such as manufacturing, government and trade was made by Professor John

W. Alexander in his "Economic Base Study of Madison, Wisconsin." Professor Richard B. Andrews has made recent contributions in clarifying the terminology.

The economic base method has been applied recently to estimating the future population of cities for planning purposes. It has also been used in estimating areas needed for growth of different types of land uses in New York City and the Washington metropolitan area.

The economic base method is a type of approach to the study of cities that is similar to other methods used by urban geographers. It substitutes for estimates of city population made on blind projections of past trends, or rigid formulas that are alleged to pre-determine the size of any city, a logical procedure for determining and measuring the basic support of every urban region.

MARTIN R. HUBERTY—*Water Problems of the Trans-Rocky West*

Following a brief introductory statement concerning development in the area, water problems of the Trans-Rocky West are discussed under four locational subdivisions, namely: Columbia River Basin, California hydrographic basins, The Great Basin, and the Colorado River Basin.

The Columbia River, with a mean annual runoff of approximately 180,000,000 acre feet, is the second largest river in the United States. The upper portion of the basin, part of which is in Canada, contributes half the total runoff, and the major part of the summer flow. Although only about one tenth of the stream's potential power is now developed, it produces one sixth of the nation's hydroelectric power. Water problems of the area involve further development of the water resources for power, irrigation, navigation, recreation, and flood control. Stream contamination is a problem of some concern, especially in the coastal tributaries during periods of low summer flow.

California's water problems are treated on the basis of seven hydrographic areas. Great locational disparity exists between water resources and water need. The State's total average annual runoff for a 53-year period is estimated at 71,000,000 acre feet, of which some 40 per cent occurs in the sparsely populated, wooded section in the northwestern one eighth of the state.

The great metropolitan districts in the San Francisco Bay area and in Southern California are deficient in local water supplies; so, it has been necessary to import water from great distances. The Central Valley Project, a state-conceived and Federally built enterprise, provides for the moving of water from the northern part of the Sacramento Valley southward into the San Joaquin Valley. This is a multipurpose project which has attracted national attention not only because of the magnitude of the undertaking, but also because of arguments concerning State and Federal rights.

The Great Basin embraces a little of California, most of Nevada, a large part of Utah, and minor parts of Idaho and Wyoming. It is an area of high-basin plains and many hills and mountains. As the basin is arid to semi-arid, except for the highest elevations, runoff is very low. Some water is transported into the basin

from the Colorado River basin, and plans provide for additional transfers, mainly for irrigation. Despite these transfers, it will continue to be an area with a scarce water supply. Drainage and salinity are important factors in the irrigated agriculture.

The Colorado River drains approximately 1/12 the United States, yet has an annual runoff of only about 17,000,000 acre feet. This heavily silt-ladened stream has been studied in great detail, and plans for full utilization have been made; and while the lower portion of the stream has been fairly well controlled, additional structures are required in the upper basin to provide power, water storage, reduction in debris movement, and flood control. Development of the basin as planned will eventually result in lowering the quality of the water delivered to the lower basin.

Except for most of the Columbia River Basin and for parts of the coastal section extending into Northern California, the area is one of very deficient water supply. Nowhere else have such great efforts been made to develop the surface and ground water potentialities of a region.

C. O'D. ISELIN—*A History of Oceanographic Research*

The motions of the water, both on a large scale and on a small scale, constitute a central problem in oceanography and must be taken into consideration in practically all kinds of marine research. Since the true nature of ocean currents could not be known until the chronometer became generally available to navigators, the view is taken that oceanographic research has a history of only slightly more than 100 years. Until about 1900 most of the effort in oceanographic research was confined to the many deep-sea expeditions sent out by the major maritime nations following the pioneer expedition on the "Challenger." Also during this exploratory period basic data on average surface currents and average winds were collected and analyzed at the various naval hydrographic offices. There followed a period of about 25 years when shallow water studies were emphasized. This was due to the establishment and growth of seaside biological laboratories and to increasing concern in fisheries problems. Since about 1925 there has been a resumption of interest in deep-sea oceanography, especially in the physics and chemistry of the offshore waters, and in submarine geology and geophysics. Both theoretical and experimental studies have begun to catch up with the strictly observational approach, and there have been many important instrumental advances, especially in the field of underwater acoustics.

STEPHEN B. JONES—*Possibilism and Strategic Thought*

Every independent state has some choice of policy and strategy in world affairs. Its choice will be based in part upon ideas about its place in the global environment. Since choice (or *selection*) is the core concept of "possibilism," this theory of man and environment is relevant.

Significant secondary possibilist concepts are *conditioning, invention, imposition,* and *obsolescence.* Man's selections are neither determined nor fully free; they are conditioned by nature and culture. Selections are always made through the medium

of culture, which focusses man's vision in some direction, distorts or blinds it in others. National policies and strategies show such cultural "refraction," as in the evalution of incoming information or the adoption of propaganda policies that miss the mark.

Invention is an essential concept, for man does not select from nature simply as a shopper in a store, but also as discoverer and inventor. Without invention there would be no culture; without culture there could be no choice. Atomic energy might be considered a selection from nature conditioned by the technological level, but this view gives a misleading impression of the process of scientific discovery.

Impositions are selections that lead to disharmonious relations to the environment. Sometimes they are merely inconvenient, like rectangular streets on a hilly site; sometimes they are disastrous, like humid-land farming in arid regions. Unsound strategic choices may lead to disastrous impositions. Hitler's attempts to apply strategic ideas successful in limited land spaces to Britain and Russia provide an example. The obsolescence of choices is self-explanatory.

To illustrate the relationship of possibilism and strategic thought, the fictional example of Forester's THE SKY AND THE FOREST is given. The strategic horizon of a Congo village chief is widened by contact with Arab slavers from whom he learns new techniques of power. His rising empire is destroyed by the superior ideas and techniques of the Belgians. The three stages of selection occur in the same natural environment through different cultural media. Analogies are drawn between this fictional example and the evolution of strategic thought in Australia, from early reliance upon Britain through inadequate regional defense schemes to the United Nations and the ANZUS pact.

An important condition of strategic choice is the "locus of power application." National power must be in forms (as well as quantities) suitable for application in decisive locations. This is true of non-military and even non-material factors of power. It may be fallacious to think only of the *initial* loci—where, in any international competition, power application begins. This fallacy permeates much popular thinking about "liberation," pacifism, isolationism, and even the containment policy. More significant is the concept of the *ultimate* locus of power application implicit in every strategic choice. Having started down a strategic path, a nation cannot always stop where it wishes. This was illustrated in both the European and Pacific theaters of the Second World War. Popular unwillingness to face the consequences of this concept, prior to the outbreak of war or other power competition, is widespread.

JOHN E. KESSELI—*A Geomorphology Suited to the Needs of Geographers*

In the past four years, the relation of geomorphology to geography has been discussed before the Association of American Geographers by Richard J. Russell and Kirk Bryan. Russell postulated that present-day geomorphology is too geological for the purposes of human geographers who would prefer a geographical geomorphology which would provide factual information on landforms and their distribution. In reply to Russell's address, Kirk Bryan maintained a year later

that present-day geomorphology is very well suited for human geographers since it provides an understanding of the landforms through consideration of their origin as advocated by W. M. Davis. Neither Russell nor Bryan encouraged geographers to undertake geomorphic investigations.

A review of the reasoning of the two authors is undertaken showing that Russell is more logical and that a geomorphology appropriate to the demands of geography still remains to be developed. Accepting Russell's suggestion that a geographic geomorphology should stress location and distribution of landforms, it is argued a) that this desired geomorphology need not concern itself with origin of the landforms; b) that this geographic geomorphology should divorce itself from an explanatory terminology and use a descriptive terminology instead; c) that this geomorphology could be developed by recognizing and defining landform types, a procedure which would follow the methods applied in the investigation of climate, vegetation, and soils; d) that the landforms themselves should be mapped by the use of appropriate symbols, following methods used by European geomorphologists in constructing morphographic maps; and e) that physical as well as human geographers could contribute to the development of this desired geographic geomorphology.

GEORGE KISH—*The Pontine Fields: Cultural Change Through Inner Colonization*

The Pontine Marshes, an area of some 300 square miles, lie southeast of Rome, along the Tyrrhenian coast. Once, during the early days of Roman rule, a flourishing region of prosperous towns and farms, it lost most of its population as a result of civil wars and foreign invasions, and became a desolate wilderness of maquis, marsh, and coastal swamp, infested with malaria, and shunned by people. In spite of repeated efforts of reclaiming this region, it was not until the 1930's that it was resettled, as a result of intensive and costly reclamation efforts by the Fascist regime.

The Pontine Fields, as they are now called, have been transformed, for the most part, into farms, some 3000 in number; four cities of over 10,000 people, and several rural centers have also come into existence, all of this resettlement having taken place between 1930 and 1939. One of the striking features of the process has been the change of the cultural characteristics of the Pontine area, due primarily to the fact that the vast majority of the new settlers came from northern Italy, most of them from the lower Po valley. The resulting differences between the people and the settlements of the Pontine Fields and the inhabitants and settled places of the surrounding districts of Lazio are evident both in ways easy to define, such as differences in dress, in ways and means of locomotion, in forms and patterns of land use, and in ways more subtle, but nonetheless visible, e.g. the "tempo" of life in the towns and villages of the Pontine lowlands, the forms of speech used there, the political beliefs and voting habits.

As a result of internal colonization, the entire cultural pattern of the Pontine Fields was changed, becoming, in effect, a small island of north Italians in the midst of a typical southern Italian region.

ROBERT C. KLOVE—*Urban and Metropolitan Population Trends and Patterns*

This is a study of the patterns of population growth trends in recent decades by small areas (census tracts) in seven large metropolitan cities: Chicago, Philadelphia, Los Angeles, Baltimore, Cleveland, St. Louis, and Atlanta. It is introduced by a brief review of the urbanization of the United States from 1790 to 1950 and future forecasts, an indication of the major regional urban population changes from 1920 to 1950, and a more detailed illustrated analysis of population changes in standard metropolitan areas during the recent decade, 1940–50.

Over 15 million of the 19 million total population increase in the United States between 1940 and 1950 were in standard metropolitan areas and much the greater part was urban. The central cities of the standard metropolitan areas (SMA's) increased only a little over 6 million while the area outside the central cities in the SMA's increased over 9 million. Of all the census geographic divisions, both the absolute increase in SMA population and the rate of growth was highest in the Pacific States. The Western and Southern geographic divisions all had higher SMA rates of growth than any of the North Central and Northeastern divisions.

The decentralization process is analysed in the population trend maps of the selected seven large cities. Major conclusions are:

1) All of these cities have larger or smaller cores of declining population. In some cities it appears that decentralization is just beginning; in others it is well along and is best demonstrated in the growth pattern of Cleveland.

2) Almost all core areas have had important areas of recent population growth, parts of which represent reversals of the 1930–40 trend. Much of this growth, but certainly not all, was due to increases in Negro occupancy.

3) All of these cities have large areas which are still growing more or less rapidly.

FRED KNIFFEN—*Whither Cultural Geography?*

Cultural geography has not received recognition recently as a distinct part of the field, although many American students consider themselves cultural geographers. It is the purpose of this paper to find if there is an important place for cultural geography and to see what the goals of cultural geography are.

Cultural geography is deemed a social science. As such it should first order and interpret its data, man's works appearing on the earth's surface, to contribute ultimately to the understanding of human behavior even to the point of prediction. Man-land relations must be the aspect of human behavior to be studied by geographers, and prediction falls in the realm of what man is going to do with respect to earth qualities.

Three factors produce the data with which cultural geography is concerned: man the animal; the physical earth; and culture. For the cultural geographer man is largely a constant factor in both time and space; the physical earth is relatively constant in time, but a variable in space; culture is a variable in both time and space. Culture is then the great variable factor that may reflect earth qualities and effects the patterns of earth occupance.

It is important for the geographer to know that culture consists of an evolving technical competence and a changing code of values, both of which contribute to man's behavior patterns with respect to earth qualities. A culture has a certain independence of its own practitioners; its logic may be at odds with humanistic thinking. Cultures clearly bear a relationship to the areas they occupy, but the range of adaptation is so great and the factors affecting cultural behavior so numerous that care must be taken to avoid false causal correlation.

Universals bearing on man-land relations are to be found in abstracted properties or processes, not in specific phenomena. A few such generalizations are derived from research in cultural geography. Prediction is ventured from trends that bear in their cultural composition the signs of continuing development.

WILBUR R. LAMB—*Geography as Applied to Railroad Industrial Development*

This paper is concerned with the application of geography in the field of railroad industrial development. It approaches the subject by first describing the objectives and functions of a railroad industrial development department and then points out how geographic training can be applied to certain of the problems of the department.

In accomplishing its objective of attracting new industries to locate adjacent to its lines, the railroad industrial development department uses two approaches. One is to work with communities it serves on problems of industrial development. The other is to work directly with the industry which is looking for a new location.

Working with communities involves cooperation on such problems as planning, zoning, and the setting up of industrial districts. The railroad also prepares industrial surveys of various communities for distribution to industries which show an interest in a particular locality.

To aid the industry in making decisions concerning community and site selection the railroad uses two methods. The first, the most direct, method is to meet with representatives from the industry for an on-the-ground inspection of sites in communities within the region selected by the industry. This enables representatives of the industry to see first-hand the relative merits of each site, and obtain some impression as to the attitude of a particular community toward additional industrialization.

The second method is to secure from the industry all the pertinent information concerning its requirements for a location, and then submit a report suggesting several sites where these requirements might be fulfilled. This is followed up by personal contact and an on-the-ground inspection trip.

In this type of work the geographer, who has been trained to view an area problem in its entirety, has a decided advantage, since he is able to approach a solution to a problem without becoming grossly involved in any one particular phase. Training in urban geography is especially helpful when working with community industrial development problems, particularly in determining the potential of certain areas of a community with respect to industrial development.

Likewise skills in map reading, map interpretation, and aerial photograph interpretation are applied continually, especially when approaching a problem in unfamiliar area, or when lack of time prevents a field inspection trip.

DOUGLAS H. K. LEE—*Dynamism in Climatology*

A field of study may be described as living only when is shows the characteristics of life—response to stimuli, expenditure of energy, growth, and production of offspring. These phenomena must operate within some framework of order, but without undue confinement; avoiding the dead hand of authority on the one hand, and the anarchy of complete independence on the other. Life inevitably brings conflict and competition, success and failure, satisfaction and frustration; but it evolves.

By these criteria climatology is certainly alive. Individuals try to create order, but none is allowed to impose it. The succeeding papers of the Climatology Session present some, but only some of its facets. The first, though it might appear to be the antithesis of dynamic, presents a procedure essential to any scientific development—the establishment of statistical associations between observed variables (Thom). The second seeks to enquire "why?" rather than "what?," at least in respect of one matter—the interchange of energy between terrain and atmosphere (Thornthwaite). The third, proceeding from here, seeks to establish associations between the energetics of a particular location and the numerous other topological characteristics which go to make up the concept of "site"; but as much by empathetic as by statistical integration (Hare). None of these papers pass on to the applications of climatology to the practical problems of agriculture, animal production, or human welfare; yet these problems provide the stimuli and the nutrients without which life would soon cease to exist in the subject. On behalf of the subject the Chairman makes at least a formal obeisance.

JOHN LEIGHLY—*What Has Happened to Physical Geography?*

Geography gained a place in American universities, in the latter part of the nineteenth century, in the form of physical geography. Its content and method were not in dispute; its self-evident task was to seek comprehension of terrestrial phenomena through application of the insights provided by the physical sciences. W. M. Davis brought this stage to an end in the middle 1890's by adopting the notion that geography is concerned, not with the things observable at the surface of the earth and the processes active among them, but with "relations" assumed to exist between these features and processes on the one hand and organic phenomena on the other. Davis's prestige and unremitting advocacy led to the general adoption of his view.

Within a few years at the beginning of this century Davis's definition was narrowed to a concern with the relations of human societies to the earth, and these relations hardened into "influences" directed from nature toward man. This definition attracted to geography a body of adherents whose primary goal was a mechan-

istic explanation of history. There was a place for physical geography in Davis's conceptual structure, but none in a geography concerned with "influences," in which the physical features of the earth were simply taken as given. Later interpretations of the task of geography have granted to physical geography as subordinate a role as the advocates of "influences" begrudged it. In the hands of those who saw in geography only the investigation of regional economies, it was degraded to an inventory of the physical components of "regions" that have economic value.

There are some faint signs that the pendulum may have begun to swing away from the narrow interpretation that has dominated American academic geography for a generation. Physical geography, with its rich intellectual content, may regain its place if the arbitrary and restrictive character of the definitions that have been accepted is recognized, and the investigation of processes placed at the focus of the discipline of geography.

TREVOR LLOYD—*Some Aspects of the Political Geography of Arctic North America*

The term "Arctic" is used loosely in the present case to include Alaska and northern Canada (Northwest Territories, Labrador, and Quebec north of 52° N. Lat.). Attention is focused on a few topics, such as the basis and extent of territorial sovereignty in this area, with some reference to significant boundary questions and the possible political consequences of increased economic and military activities upon them.

The historical backgrounds of sovereignty in Alaska, Canada, and Greenland are summarized, followed by a discussion of the "Sector theory" especially as applied to waters north of Canada, and in the light of future international commercial aviation developments. The status of United States (NATO) military bases, weather stations, and other activities in Greenland and Canada is also described.

J. ROSS MACKAY—*Experiments with Some Symbols and Map Projections*

A cartographer has a large selection of techniques at his disposal in designing a map, but he has only a paucity of information available to him on probable group reactions of map readers—whether school children, college students, the general public, or his professional colleagues—to guide him in the technique of his choice. The purpose of this paper is to present some of the empirical data on group reactions that have been derived from tests given to three hundred college students in Canada, and, through the co-operation of Mr. Kanji Kagami of Nagoya, Japan, to one hundred and twenty Japanese students. Each test was given to two groups of students, one with and the other without cartographic training. The minimum number of students involved in a test was twenty-five.

Experiments were conducted with dots, circles, spheres, cubes, and isolines by asking students to answer questions pertaining to numbers, sizes, personal preferences, etc. Several tests were made on equivalent projections by asking students to estimate areas. The visual conformality of Greenland and Australia, as they appeared on six different map projections, was compared and rated by students against their shapes on globes.

The principal results of the tests are summarized as follows:

1) cartographic training, or its lack, appreciably affects the accuracy of map reading;
2) map reading is greatly improved by laboratory practice in estimating and comparing numbers, areas, volumes, shapes, etc.;
3) the group preferences for quantitative symbols and map projections vary with the cartographic training of the students, and the "best" method for one group may be unsatisfactory for another;
4) most students, whether cartographically trained or not, experience some difficulty in recognizing ten per cent differences in dot numbers and higher percentages when areas and volumes are involved: therefore, significant geographical differences that lie below the limits of easy recognition for a particular symbol should preferably not be represented on a map by that symbol;
5) students tend to underestimate areas and volumes when a large area or volume is estimated in terms of a smaller one;
6) the visual estimation of areas on equivalent projections is generally not within a fifteen per cent accuracy;
and 7) portions of some conformal projections, when visually compared with the corresponding areas on a globe, may look less conformal than similar areas of some non-conformal projections.

HAROLD MAYER—*Accessibility as a Measure of the Extent of Urban Nodality in the Chicago Region*

Cities exist mainly to provide goods and services for regions outside of their own built-up areas. These regions vary in extent, depending upon the nature of the functions of the respective cities, and upon competition among the cities with respect to each function. Urban regions are not mutually exclusive, but exist as hierarchies of regions. The regions of the smaller and functionally less complex urban sub-centers are contained within the region of a larger center. They look to the sub-centers to contribute specialized and often competing services of more local extent, within the region of the larger center. Geographic studies of city-regional relations have mainly been concerned with the hinterlands or trade areas of individual cities, the extent of the competitve regions of cities of the same general magnitude, or the hierarchy of urban centers and regions of varying magnitudes. Among studies of the latter type, one is being carried on of the Chicago Region. It is concerned with the relations of smaller cities and towns and their regions to the metropolitan center and its region.

One of the principal measures of relations between the metropolitan center and the smaller urban centers within the region is relative accessibility. Relative accessibility may be studied as a series of flows of people and goods between the outlying cities and towns and the major metropolitan regional focus, in both directions. Although Chicago is the center of many functions, and hence flows, which are interstate and international in extent on the one hand and intra-metropolitan on the other, many functions exist, and are evidenced by traffic flows, within a region of intermediate extent.

A hypothesis is being tested that, for Chicago, such a region includes the area within 100 to 150 miles radius from the central city. Several series of relationships exist within that area, focusing upon Chicago, which appear to be as significant as the relationships between Chicago and competitive major cities on the one hand and between the central part of Chicago and outlying portions of its metropolitan area on the other. Relative accessibility is a major consideration in the determination and measurement of relationships between Chicago and the smaller cities and towns within its region.

HAROLD H. MCCARTY—*Land-Use Competition between Wheat and Corn in the North American Middle West*

One of the main purposes of research in agricultural geography is to discover principles that will account for variations in the popularity of individual crops. When these principles are finally perfected it appears that they will consist of equations having many variables. Establishment of the nature and importance of those variables requires extensive measurement over considerable periods of years and in widely dispersed areas. It seems, however, that a start may be made by establishing the importance of a few variables in a relatively small area. It was to that end that the distribution of wheat acreages in the Middle West was examined with particular reference to its relations with yields of wheat, yields of corn, and a variety of climatic factors.

Results showed a positive correlation between wheat yields and wheat acreages in a relatively narrow zone that lies generally near the southern and western margins of the Corn Belt. Here yields of both wheat and corn are only moderate and there appears to be considerable land-use competition between the two grains, although corn is everywhere the more important crop with wheat assuming major importance only where corn yields are relatively low. Outside this belt there are marked negative relationships between wheat yields and wheat acreages. In the Corn Belt small acreages generally accompany high yields, while in the Wheat Belts these relationships are reversed. In the Wheat Belts this disparity is greatest where precipitation is lightest and decreases with increases in precipitation. In the Corn Belt the disparity is greatest where corn yields are highest and decreases with decreasing corn yields.

Predictions based on these measurements would be true only within relatively broad limits, and certain fairly obvious refinements could be made to make the findings more useful. It is felt, however, that sufficient evidence has been accumulated to warrant the inclusion of both yield and climatic factors, as well as conditions surrounding land-use competition with corn, in future attempts to discover the variables that may ultimately be used to account for variations in the popularity of wheat.

PEVERIL MEIGS—*Fifty Years of Tides and Waves in Western Agricultural Geography*

In 1900, livestock products and field crops were the two main types of farm production in the eleven states that make up the West of the U. S. Census. They

still are today. Most of the potential grazing range, which means most of the West, was in use by 1900; the pioneering was essentially finished. Most of the public domain was unreserved except for Indian reservations. Bonanza grain production, highly mechanized with horse-drawn machinery, held sway in the Central Valley of California and in eastern Washington and Oregon. The railroad arteries making possible the commercial agriculture of the West had been built.

The great fruit, nut, and vegetable industry was in its early stages, although most of the future irrigated areas had at least been proved up. Wine, dried fruit, olive oil, and citrus fruit were being shipped east from California. The northwestern dairy area was in early stages of development.

A four-fold increase in irrigated area in 50 years has permitted the introduction of rice and cotton into the Western economy and the rise of a horticultural industry that makes California the producer of half the fruits and nuts of the United States and a third of the commercial vegetables, besides lesser proportions in the other Western states. The Federal Bureau of Reclamation has helped plan, finance, and execute the larger irrigation projects.

The first ten years of the century saw the inauguration of large-scale Federal irrigation, the creation of National Forests almost to their present extent, and a goverment campaign of plant exploration and introduction. Federal support of agriculture has increased ever since then, accelerated by periods of hard times. The Hoover administration created the Federal Farm Board in 1929 to buy up food surpluses and make farm loans. The Roosevelt administration in 1933 created the Farm Relief Act to control agricultural production. Support of farm prices seems now to be an established institution. The Federal support program affects the horticulture of the West less than staple crops.

Irrigation and mechanization involve higher capitalization and intensiveness of farm operations. Tractors, automobiles, and electricity have risen from nothing in 1900 to an essential part of the average farm in 1950. In horticulture, increased specialization has led to larger farms and factory-type production. There is also a recent trend towards more small farms of a part-time suburban or semiretired character.

The growing population of the United States requires increasing amounts of agricultural porduction. The spectacular growth of the far western states results in greater local absorption of western products, and the rise of local dairying and truck farm production.

Waves of farm prosperity and depression have accompanied periods of high or low farm prices, affecting the West as well as the rest of the country, but with important differences. Five pronounced economic waves and troughs can be summarized for the first half of this century, as well as innumerable wavelets and ripples.

1900–1915. *Steady growth.* Slowly rising prices. Federal reclamation, National Forests, plant introduction. Horticultural beginnings.

1915–1920. *War boom.* Foreign demand. Mechanization intensified. Rice in California.

1920–1929. *Agricultural decline.* Debt increase. Advanced mechanization. Direct Federal aid. Principal fruit and nut planting surge in California, and many truck crops hit their stride.

1929–1942. *General depression.* Dust storms. Increased Federal control. New reclamation projects. Virtual end of homesteading in 1934 as grazing lands become Federal reserve.

1942–1953. *War boom.* Military and foreign markets. Large United States and Western population increase. Revival of fruit and nut planting in California. Western cotton hits stride. Frozen food inspires truck crops.

HOWARD J. NELSON—*Urbanization in the Trans-Rocky West*

Home for the Westerner is not "on the range," but in a crowded urban area. Three out of four of the people in the area are urban dwellers; half live in five large urban centers. Though concentration seems to have been characteristic of Western settlement in both the recent and distant past, urbanization is currently increasing rapidly. The five million person increase of the area in the past decade has accumulated almost entirely in the cities.

The West is a diverse area, and diversity also characterizes its thirty-odd metropolitan areas. Though the Oasis Cities of the Basin and Range Province have similar water-oriented sites, the Mormon background of the cities of Utah, the unique laws of Nevada, and the persistantly sunny climate of Arizona, endow each group of centers with distinctive personalities. Distinct, too, are the service centers of the Great Valley of California and of the Pacific Northwest. And no one on the spot would confuse any of the Metropolitan Giants of the Pacific Shore, Seattle, Portland, San Francisco, Los Angeles, and San Diego, with each other, although, again, the sites and situations of all of these cities have much in common.

The assets of the West, such as climate, large harnessable rivers, irrigable land, petroleum and other minerals, and softwood forests have reached maturity only in terms of Twentieth Century technological developments. The cities of the West, based on these resources, are also creations of the present era. Even many of the problems of the West's cities, adequate water supplies, atmospheric pollution, and automobile congestion, as well as "urban sprawl," are products of the current age. Any continuation of the past rates of unbanization in the Trans-Rocky West into the future will require the solution of these and other problems.

LOUIS C. PELTIER—*Some Properties of the Average Topographic Slope*

Average topographic slope was calculated for 70 maps using Wentworth's methods. The average slope so calculated is shown to be empirically related to, and to vary directly with, the average local relief for one-square-mile areas according to the formula presented: $S = 0.024R - 0.66$, where S represents the average slope in degrees and R represents the average local relief in feet. The average texture of the topography as expressed by the average number of gullies, arroyos, ravines, and small valleys per linear mile of transect also varies directly with the

average slope. For erosional landforms, however, the rate of change of texture with slope varies according to the rainfall. The average texture of the topography varies more rapidly with slope in fine-grained, well-sorted, loose, unconsolidated materials than in coarse, poorly sorted and compact but poorly consolidated materials.

The slopes of selected areas were further classified as: hilltop slopes, side slopes, foot slopes, and bottom slopes; and the average for each class was calculated. These data suggest that slopes may be classified on the basis of modal values into seven categories: flat ($< 3°$), very gentle (3°–7°), gentle (7°–13°), moderate (13°–21°), steep (21°–31°), very steep (31°–43°), and precipitous ($> 43°$). The four-class averages also reveal a systematic variation in proportion and inclination with progress of the geographic cycle of erosion.

Calculations of average topographic slope, or measurements of local relief, may be employed in the rough estimate of civil and economic projects. These would normally include the costs of highway and railroad construction, the estimate of relative accessibility of specific places, the incidence of arable land and sites for factories, airfields, reservoirs or urban development, and even the estimate of the general level of physiologic metabolic costs attendant upon human activity in an area.

(To be concluded in the September issue.)